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THE PSYCHOLOGICAL REVIEW.

THE PSYCHOLOGICAL STANDPOINT.

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I.

The plain man who is innocent of special psychological culture, and has only the knowledge of his own mind and of other minds which is forced upon him by experience and the unavoidable half-conscious reflection upon experience to which one is led by every-day life, is still pretty well provided with psychological knowledge of a certain sort, and he uses with some skill the psychological methods in vogue in the schools. His thinking is by no means clear, it is sometimes quite inconsistent, it is limited to a narrow field. Still, I should hold it to be, in embryo, psychology as natural science, for it is psychology from the standpoint of the common understanding, and in thinking about minds and their relations to things the plain man thinks very much as he does when he is concerned with material objects. He believes that he has a mind, though he has no very distinct notion of what it is. He believes that this mind is intimately related to his body, which is a thing outside of his mind. He believes that through this body it is related to an external real world, from which it receives influences and which it can influence in return. In this external world he thinks he finds other bodies more or less like his own, and believes that there are, connected with them, other minds, as his mind is connected with his body. Further, he believes that, as he can express by actions of his body ideas or emotions in his mind, so the minds connected with other bodies can give

XUM

expression to their ideas or emotions, and such an expression is to him the revelation of the contents of these other minds. He thus compares the mental states of other men with his own, and forms some general notions of the contents of minds and the ways in which they act, thus arriving at the beginning of a mental science. He may have done all this without even having heard of the science of psychology.

The handbooks of psychology describe at length the stages by which our plain man arrives at the knowledge of minds which he possesses, and describe it much better than the possessor himself could do. His thinking has been half-conscious and unanalytic; he has rather felt his way than seen it. And yet we may note that the psychologist, in obtaining the knowledge which has made it possible for him to write such a description, has followed no method not already applied by the unscientific subject of his description. Our subject has had recourse to introspection; he has made use of the objective method; he has not confined himself wholly to passive observation, but has sometimes experimented. Experience of his own conscious states has given him the key which is to make significant the expressions and actions of other men and of brutes. He has certainly observed these expressions and actions, and framed a more general notion of mind than he could have done by a mere examination of his own mental processes. And every time he has sought by persuasion or by any other means to produce a given mental state in another he has employed experiment, as does the *galopin* who rides on the back-platform of the bob-tailed car, at a personal inconvenience to himself, with the avowed purpose of getting the driver 'wild.' Of course, such introspection as we are discussing is blind and instinctive, such observation is loose and inaccurate, such experiment is undertaken for no scientific purpose, and sins in all sorts of ways against the canons of experimental investigation. Nevertheless, they remain introspection, observation, and experiment. The difference between the plain man and the psychologist does not lie in the fact that the latter uses any method peculiar to himself, esoteric and above the comprehension of the unlearned. It is simply a case of the difference everywhere found between the scientific

and the unscientific, the man who applies methods carefully and seeks accurate and exhaustive knowledge of a subject, and the man who feels his way blindly, going only so far as he is impelled to go by immediate practical needs. The knowledge of mind gained by the plain man is loose and vague, more or less inconsistent, and very limited in extent. Yet it is, as far as it goes, a knowledge of mind, and does not differ in kind from that of the psychologist.

II.

Now that psychology is emerging gradually from that ill-defined medley which has passed by the name of philosophy, and is taking its place as a distinct discipline, it is coming, I think, to be generally accepted that the psychologist must occupy much the same standpoint as the ordinary man. I do not, of course, mean that he must be as loose and careless in his thinking, but that he must be scientific rather than metaphysical, accepting without question the assumptions upon which the natural sciences rest, and investigating the phenomena of mind much as they investigate material phenomena. The plain man becomes more careful and accurate when he becomes scientific, but he does not change his whole point of view. He is still in a real world of things about which he reasons as he did before. As a plain man he knew something about plants; as a botanist he knows much more, but he has passed through no intellectual revolution in becoming a botanist. There in the real world are real plants which he may examine, and upon which he may try experiments. The results obtained by the botanist are sufficiently intelligible to him, even if he be a very poor botanist himself. They are expressed in a language of which he has always known at least the rudiments. And the physiologist assumes an external world, in which are a number of organized bodies, forming a part of a real system of things. He seeks to obtain a general knowledge of the peculiar phenomena presented by these bodies, and to fix their relations to the rest of the system. Every one knows something about physiology, even if he has never heard the word pronounced. One may know very little

indeed, but even in that case one's ignorance differs from that of the physiologist only in degree. The point of view is essentially the same. Lungs are lungs, and exist and function in a real external world among other real things, and the only problem is to discover how they conduct themselves there. Physiological truths do not lead one away from the ways of thinking to which one is accustomed in common life.

In the same way the psychologist assumes an external real world, the world of matter and motion. In this world there are organized bodies presenting certain peculiar phenomena which he regards as indications of mental action. He accepts a plurality of minds distinct from each other and from the system of material things, each standing in a peculiar and intimate relation to one body. Each mind knows directly its own states, and knows everything else by inference from those states, receiving messages along certain bodily channels and reacting along others. Upon this basis he strives to give an accurate account of the contents of minds and to trace the history of their development. He stands upon the same ground as the ordinary man, and, as has been said above, he follows the same methods in his investigations, making use of introspection, observation, and experiment. He applies the methods in a broader and more scientific way; he is clearer, and more exact and thorough; but he remains a student of 'natural science.' However he may modify, as a result of his studies, his views of minds and of their relation to a material world, he still holds to the existence of distinct individual minds in certain relations to such a world and through that to each other. He conceives each as shut up to its representations of things, and dependent upon messages conveyed to it from without, as does the disciple of Locke. Ideas are, to him, like images in a mirror, numerically distinct from the things which they represent, and of which they give information.

A psychologist is, it is true, also a man, and he may be a metaphysician or epistemologist as well as a psychologist. In such capacity he may have his own opinion about these psychological assumptions. He may be a natural dualist or a hypothetical realist, a materialist or an idealist. As a phi-

losopher he is free to choose, but not as a psychologist. In the latter capacity he puts all this aside, and remains on the plane of the common understanding, the plane of natural science. There is, of course, much that is vague in the thinking of the man who rests wholly on the plane of natural science. The physicist may have no very clear notion of what he really means by matter and energy, and yet he may be a good physicist. He may experiment with ingenuity, and observe and record phenomena with accuracy. And the psychologist may have the vaguest of notions as to the whole connotation of the word 'mind,' or of the phrase 'a material world,' and yet he may be a good psychologist, and materially add to our knowledge of minds. If he has not carried on with some measure of success the sort of reflective thinking demanded in epistemology or metaphysics, he will probably mix from time to time with his psychology more or less crude material that is not strictly psychological. But this is on his part a work of supererogation. He has the right, as has the physicist, to work in his own field, and to make use of some concepts he has not completely analyzed.

III.

It must be admitted that the position regarding minds and their relation to an external world taken by the plain man and by the psychologist contains, when criticised from the standpoint of epistemology, that most serious of difficulties, a flat contradiction. It assumes that each mind has only its representative images of things, and not the things themselves. When it asks how a given mind comes to have a knowledge of an external thing, it concerns itself with the messages that have been conveyed to the mind, the materials, so to speak, out of which the image has been built up. It describes the process of building up such an image, and, distinguishing sharply between the image and the thing, maintains that the mind knows only so much about the thing as is contained in this image or in other images obtained in the same way. It admits that, given such an image in the absence of the thing (a hallucination), the mind will have

absolutely no way of knowing the thing absent except by referring to its other experiences and assuming this one, as abnormal, to be a false representative, and without a corresponding reality behind it. In other words, it shuts the mind up to its own circle of consciousness, and makes the external world present to it only by proxy. The outer world, *as the mind knows it*, is a complex mental experience, built up out of mental elements, and not the real outer world at all. It is only something that stands for the real outer world. Thus the very idea 'outer' is, to the mind possessing it, only a something in consciousness—an inner representative of genuine externality, but, in itself, not external at all.

Yet all this rests upon reasoning in which it has been assumed that the mind is *not* shut up to its own experiences, but directly knows an external world of things. A man looks at his own body, the body of his neighbor, and some material object in front of which both are standing, and he seems to himself to be immediately conscious of all three. He grants his neighbor a knowledge of the object, reasoning as I have indicated in an earlier section, and distinguishes between this man's knowledge of the object and the object itself. The former he makes a representative of the latter, connects it in thought with the man's brain, and admits that it may even not wholly resemble the object as he sees it. He holds that the man is not directly conscious of the object itself, but infers it through the representative image. He then applies the same reasoning to himself, and concludes that he is himself not really conscious of the three objects with which he started, but only of representative images. Through such images he must infer the whole outer world —his own body, other men, other things.

But if he is not really conscious of his own body, the other man's body, and the real object, what becomes of his reasoning? Of what is the other man's image representative, and with what is it connected? Is it representative of an external object? The object which it has been assumed to represent is now seen to be an image in his own consciousness, and there is not a shadow of evidence that it represents any other. With what brain is it connected?

The brain belonging to that body which is under observation? That body, too, is now seen to be his own image and relegated to consciousness. And what do his own images represent and where are they? His image of the object cannot represent that object seen out there in front of his body. That object *is* his image, if he is shut up to images, and his body as perceived is another image in his consciousness with the object. The real object, the real body, are things to be inferred. They are not open to direct inspection. His image of the thing must not be referred to the brain which belongs to the body of whose existence he is directly aware. It must be referred to a brain in a totally different world. Where look for evidence that it is connected with any such brain in any such body? Yet evidence must be adduced for all this. The doctrine that there is an external world, and that it is mirrored by a number of minds which are shut up to their own representations of it, is not usually advanced as a gratuitous fiction. It is supposed to rest upon evidence. Is not one conscious of one's own mental experiences? Can one not observe the relations of these to the material world? Can one not arrive by analogical reasoning at some notion of the mental states of others, and apply one's results to one's self? The appeal is to experience, to observation and induction. And yet if the conclusion of the argument be true, the foundation upon which it rests is a delusion. If one be really shut up to one's own mental states, one has never observed their relations to material things, and never inferred from changes in material things the mental states of another. It is a strange argument that rests upon an assumption which its conclusion declares to be false.

The difficulty here pointed out is not assumed gratuitously. It is really inseparable from the psychological position both of the plain man and of the psychologist, though it is forced into greater prominence by the superior consistency and clearness of the latter. The plain man distinguishes in his loose fashion between a man's ideas of things and the things themselves, and he admits that if the ideas are not true representatives, their possessor will not truly know the things.

The psychologist makes more distinct the line of separation, and conceives the man's whole experience of an outer world as a mere copy of what is external, describing in detail the elements of which it is built up, and the process of its formation. Both hold, explicitly or implicitly, that we perceive directly the outer world, and that we do not so perceive it, but only infer it. The contradiction is there. It is imbedded in the very structure of the psychological position, the standpoint of common thought and natural science.* Psychology is not called upon to solve it, for it does not concern psychology. The psychologist has done and still does excellent work while simply disregarding it. It may safely be left to the epistemologist.

And the epistemologist, if he be wise, will not quarrel with the psychological standpoint. He will recognize its value as a basis for work of a certain kind, and he will object to the psychologist's mixing with his psychology reasonings which, however true and valuable in themselves, serve only to darken counsel when mingled injudiciously with other things. He may, as epistemologist, point out where the difficulty really lies, show why the psychologist's assumption does not lead to error, and indicate how the results obtained by him are true even for epistemology when restated in certain ways. But he will regard such discussions as more or less out of place in a text-book of psychology, and regret finding them there, much as he would regret finding

* I shall not here discuss at length the peculiar philosophical doctrine which attempts to hold to the psychological standpoint and remove the contradiction by declaring that both the ideas and the things are really given in experience. One need only read what has been written in support of it to be convinced that its adherents, after distinguishing between ideas and things, confound them completely. If consciousness testifies to anything clearly and unmistakably, it is to the fact that we do not under normal circumstances see things double. The inkstand in front of me I see. I see only one. I may call that one *idea* or *thing* as I please. I am certainly not conscious in looking at it of both a copy and an original. How would a hallucination be possible if, in addition to the image, there were immediately present to the mind in perception also the thing represented by the image? The absence of the thing would be remarked at once. The doctrine is bad as psychology, and bad as epistemology. It cannot afford to be really clear, and it wisely takes refuge in obscurity, making the phrase 'knowledge of things' unintelligible. I shall again touch upon this point later.

metaphysical reflections introduced to any great extent in a treatise on physics.

IV.

The psychologist should, then, frankly accept the standpoint of common thinking, the natural science standpoint, without attempting to make it consistent. He should accept without question an external world; should assume that his own ideas of things represent it, and can be proved by observation to represent it truly; should infer from the actions of other bodies ideas more or less like his own, which are representatives of external things as are his ideas.* He should then, in harmony with the psychological fiction that no one is directly conscious of external real things, assume that each mind is shut up to its own representations; that the world is mirrored in each consciousness, and that the pictures of it in different minds may differ. To him each mind's knowledge of the external world should mean the presence in it of such a picture—of such and such mental elements arranged in such and such ways. He can then set before himself the difficult but perfectly definite task of discovering just the elements present in a consciousness, and the method of their arrangement. He may describe the building up of a consciousness, and may relate everything in it to the system of real things in an intelligible way. His work is, in a real sense of the word, scientific, and resembles closely what scientific men are trying to do in other fields. It does not demand metaphysical reflection. And the best results are to be obtained in psychology, I feel sure, by holding firmly to this scientific standpoint. When it is abandoned, as it sometimes is even by men whom one would most naturally expect to be strictly 'scientific,' the resulting obscurity and confusion are positively depressing to a lover of clear thinking. Of course, until epistemology as well as psychology has done its perfect work all one's thinking will not be perfectly clear. The plain man and the scientist both employ, as has

* I, of course, do not limit a consciousness to such ideas with 'objective reference.'

been indicated above, some conceptions that they have not completely analyzed. Such obscurities in their thought need not prevent it from being, as common thought or as scientific reasoning, clear and effective. One may reason well and clearly about spaces and times without being a philosopher, provided one remain on the plane of the common understanding, and ask only for scientific clearness. But when one occupied with scientific reasonings abandons the scientific standpoint, he is apt to introduce a very different kind of obscurity, and to encumber his task with serious and needless difficulties.

One or two illustrations will serve to make more clear the point upon which I wish to insist here. Within the limits dictated by an article of this kind no thought can be developed at great length. But I hope to make plain in one or two instances that psychology is a loser when the psychologist abandons the psychological standpoint, and tries to be psychologist and epistemologist at the same time.

V.

The psychological standpoint assumes, as I have said, an external world and a number of minds or consciousnesses reflecting it. To it, knowledge of the external world or knowledge in any sense means the presence of such and such complexes in a consciousness. The psychologist sets himself the task of analyzing these, exhibiting their elements, and giving an account of their genesis and their relations to other things. Now, as all external things, in so far as they are to enter a consciousness and be known, must enter through their proxies, it is of the very first importance not to conceive of the contents of a consciousness in such a way as to make it inconceivable how they can act as representatives at all. For example, the external thing to be known is a chair; the representative of this in a particular consciousness is the idea of a chair. Since a chair has legs, a seat, and a back, and is by these and other marks distinguished from other objects, must there not be in the representative, in the idea itself, something to correspond to these? If the chair has color as

well as form, must not both elements be in some way represented in the idea? Must not the arrangement of represented elements in the object have its representative in an arrangement of representing elements in the idea? If one is to have a true and complete knowledge of any external thing, must not every single element in the external object have its correlate in consciousness? Surely it is inconceivable that one and the same thing in consciousness should stand for half a dozen things outside, and yet give true knowledge of them or truly represent them. Is the external object complex and the representative idea simple, the complexity of the object is not represented at all. If we assume, as I think the psychologist must, that each man knows of things only as much as is represented in his ideas, we must conceive of his ideas as really capable of being representatives of complex things. We must make his consciousness complex.

I do not think I can better emphasize the point I am making than by referring to the treatment of consciousness contained in Professor James' able book, which every one has so lately been reading.* This paper is in no sense a general criticism of the book, to which I refer merely for the sake of illustration. The book is, however, so frank, and so positive in its statements, that one naturally turns to it rather than to another, when one wishes to find a doctrine 'writ large.'

Professor James gives as the irreducible data of psychology four things, which he emphasizes by numbering them and putting them in separate frames. These four things are the psychologist, the thought studied, the thought's object, and the psychologist's reality (vol. I. p. 184). Why he has selected as the fourth the psychologist's reality, it is a little hard to say, for he states immediately afterwards that the psychologist believes in the reality of numbers 2, 3, and 4, and he himself evidently assumes without question, throughout the book, the reality of 2 and 3. One is further puzzled to know why Professor James has omitted from his enumeration something else which he appears to distinguish from all the things mentioned above, and to treat as an irreducible datum.

* *Principles of Psychology*, N. Y. 1890.

This something, the most mysterious thing in the world (p. 216), is Knowledge. Knowledge is, it is true, spoken of in one passage as a 'particular quality' or 'cognitive function' of states of consciousness (p. 185), and it is asserted in another that 'the brain being struck, the knowledge is constituted by a new construction that occurs altogether *in* the mind' (p. 219). One who read such passages alone might be inclined to regard knowledge as 'a mode of being of ideas' or a kind of consciousness. But Professor James considers the view of knowledge which would make it "a mode of *being* of 'ideas'" as 'pitifully impotent' (p. 476); and distinguishes between thoughts (consciousness, p. 185) and knowledge, as follows: "Almost anyone will tell us that thought is a different sort of existence from things, because many sorts of thought are of no things—e.g., pleasures, pains, and emotions; others are of non-existent things—errors and fictions; others again of existent things, but in a form that is symbolic and does not resemble them—abstract ideas and concepts; whilst in the thoughts that do resemble the things they are 'of' (percepts, sensations), we can feel, alongside of the thing known, the thought of it going on as an altogther separate act and operation in the mind" (p. 297). When one reads these passages and others like them, one feels that Professor James must look upon knowledge as a something quite distinct from all that to which he refers under the various names of thoughts, feelings, mental states, and states of consciousness. He must use the word mind to indicate a something which contains both states of consciousness and knowledge, two elements differing in kind, irreducible and ultimate. Such a position, consistently held, involves one, it is true, in difficulties that must seem to the average man rather startling. If, for instance, when one perceives a chair, one directly knows the chair, and feels, alongside of this knowledge, the thought or percept, it would seem quite conceivable that one could know the chair in the absence of the percept, and the function of percepts in perceiving is not apparent. One might know all sorts of things without having any mental states at all. One would have only knowledge—no consciousness, no thoughts.

It is merely possible that Professor James has omitted

knowledge from his list of irreducibles because he does not regard it as concerning psychology at all. We naturally think of everything that can be found in a mind as a legitimate object of psychological study, but, according to an explicit statement in the chapter on 'The Methods and Snares of Psychology,' this science is limited to the study of thoughts, or states of consciousness, and their relations to things. In summing up his chapter Professor James says, with the emphasis of italics: "These thoughts are the subjective data of which he (the psychologist) treats, and their relations to their objects, to the brain, and to the rest of the world constitute the subject-matter of psychologic science." If psychology be really limited to this field, and if knowledge be something different from thoughts, of course it does not concern the psychologist. Nevertheless, in spite of the above citation, I can scarcely believe that Professor James seriously means to thus turn his back upon knowledge. He certainly uses it more or less in his psychology. I can think of only one pretext under which he may introduce it. It may be made to fall within the limits he has indicated, if it be defined as a relation between thoughts and external objects. In some passages Professor James appears to so define it. And yet, if this be the definition of knowledge, it is hard to see how knowledge can be wholly *in* the mind, and once there 'may remain there, whatever becomes of the thing' (p. 219).

I confess I am puzzled to know what to do with knowledge as treated by Professor James, but, all things considered, I think it must be added to the above-mentioned list of irreducibles—or rather may be allowed to take the place left vacant by the psychologist, the thinker, who turns out later in the book (Chapter X.) to be a thought, or pulse of consciousness. (In speaking above of the possibility of knowledge without consciousness, the knower was assumed to be an irreducible.) With his conversion into a thought, we have still on our hands thoughts or states of consciousness, objects, and knowledge. The last I will leave at this point, frankly admitting that, with all Professor James' assistance, I can form no clear notion of what he makes knowledge, or even feel certain whether he puts it in the mind or outside of it. It appears to

be distinct from consciousness and also distinct from objects known. States of consciousness are generally admitted to differ from one another, and so are objects, but whether we are to regard knowledges as differing, so that what is in one mind can be distinguished from what is in another simply by a difference in this element, I cannot guess. If there be no difference in this knowledge element, then the contents of different minds, or of the same mind at different times, must be distinguished and classified through differences in their other elements—they differ in containing different conscious states. Psychology, in so far as it is concerned in distinguishing and describing mental contents, may go on while ignoring knowledge.

To turn to something less mysterious and more familiar, conscious states—these are recognized in every psychology, and by psychology as natural science must, I think, be made to cover even what is meant by knowledge. It must regard a man's consciousness as all he gets of anything, and must conceive even his knowledge or belief that there is something beyond his consciousness as in itself a mental complex, a conscious state, which can be analyzed, and described, and the genesis of which can be traced. Since, to it, conscious states must serve as the representatives of all that is external, it must, as has been said, so think of them that it will not be impossible to conceive how they can serve as representatives at all. It may enter an energetic protest—and this is the point to which what I have said in the paragraphs preceding has been leading up—it may enter an energetic protest against Professor James' conception of consciousness as an unanalyzable, indivisible unit, a something in which no parts can be distinguished. How can such a consciousness represent any object not itself unanalyzable and indivisible? How can it represent two objects as two, or an extended thing as extended?

Professor James declares unintelligible the assumption that our mental states are composite in structure, made up of smaller states conjoined (p. 145). Consciousness he regards as 'an integral thing not made of parts' (p. 177); it is a 'single pulse of subjectivity' (p. 278), 'undivided' (p. 277), 'containing

no manifold of coexisting ideas' (p. 278). Every 'pulse of thought' (state of consciousness at a given moment) is an 'indecomposable unity' (p. 371), 'an uncompounded psychic thing' (p. 179). Feelings cannot be put together to make a consciousness: "Take a hundred of them, shuffle them and pack them as close together as you can (whatever that may mean); still each remains the same feeling it always was, shut in its own skin, windowless, ignorant of what the other feelings are and mean. There would be a hundred-and-first feeling there, if, when a group or series of such feelings were set up, a consciousness *belonging to the group as such* should emerge. And this one-hundred-and-first feeling would be a totally new fact; the one hundred original feelings might, by a curious physical law, be a signal for its *creation*, when they came together; but they would have no substantial identity with it, nor it with them, and one could never deduce the one from the others, or (in any intelligible sense) say that they *evolved* it" (p. 160). A consciousness supposed to consist of a dozen feelings Professor James compares to a sentence consisting of a dozen words each of which is in the mind of a different man. There is nowhere a consciousness of the whole sentence (p. 160).

Conscious states are, therefore, simple, unanalyzable units. They may, then, differ from each other, and be distinguished as this state or that, but they cannot be analyzed and described, they can only be named. How do sensations differ from percepts, percepts from concepts, memories from fictions? As well ask how the sensation of redness differs from that of blueness. The psychologist may arrange in a given order a number of unanalyzable units, and state their relations to other things, but a descriptive psychology which busies itself with such units can be called descriptive only by way of courtesy. It cannot give any sort of an answer to the question, 'What are they like?' or, 'How do they differ from each other?' It cannot describe. Of course Professor James does not attempt a psychology upon any such basis. When he treats of the various mental states he talks of them as does any one else, making them composite, analyzable, and describ-

able. It is because he has done so pretty consistently that he has written so good a book.

It is difficult to know, in view of the wealth of material at hand, just what to cite in illustration of the fact that Professor James does not treat consciousness as an indivisible, unanalyzable unit at all. One must, however, begin somewhere, and I shall refer to a few passages almost at random. In the opening sentences of his book Professor James does not hesitate to speak of the 'complexity' of mental phenomena (I. p. 1); a little further on he speaks of 'groups of sensations forming determinate *objects* or *things*' (I. p. 19); and on the next page he asks: 'What are perceptions but sensations grouped together?' In the same chapter he regards it as certain that consciousness is much more 'developed' in the hemispheres than it is anywhere else, and asserts that the development of will must be 'proportional to the possible complication of the consciousness' (p. 78). In the chapter on 'The Perception of Space' we find such statements as the following: "In the sensations of hearing, touch, sight, and pain we are accustomed to distinguish from among the other elements the element of voluminousness" (II. p. 134); "Now my first thesis is that this element, discernible in each and every sensation, though more developed in some than in others, is the original sensation of space" . . . (p. 135); "If a number of sensible extents are to be perceived alongside of each other and in definite order, they must appear as parts in a vaster sensible extent which can enter the mind simply and all at once" (p. 146); "Measurement implies a stuff to measure. Retinal sensations give the stuff; objective things form the yard-stick; motion does the measuring operation" (p. 267). These sentences stand out from their context in all the prominence given by italics. They have not been penned thoughtlessly. And yet one marvels to think they are intended to apply to a something in which no parts can be distinguished—to an indecomposable unity. How can such a unity have elements distinguishable from other elements, or parts which can be placed alongside of each other, or portions which can be measured? And how can one speak of what is present in imagination as a blurred picture or a sharp image, or describe it as an image surrounded by a

'fringe' composed of 'transitive' parts of consciousness, if all that is in consciousness be wholly without parts, an indecomposable unit (II. p. 49). Such partless images we might naturally suppose capable of representing only mathematical points, but we discover one of them to be the image of Professor James' absent friend. How Professor James can know of whom he is thinking is a mystery—a mystery worthy, I think, of a place beside 'knowledge' as one of the most mysterious things in all the world. What, too, shall we say to the percept, which is also indecomposable, when we find it to be the general law of perception that whilst part of what we perceive comes through our senses from the object before us, another part always comes out of our own head (II. p. 103)? or when we read: "Who can be sure, in his sensible perception of a chair, how much comes from the eye, and how much is supplied out of the previous knowledge of the mind?" (I. p. 191). And how can we regard an emotion as an indecomposable unit, when we happen upon the exclamation, "Who can enumerate all the distinct ingredients of such a complicated feeling as *anger?*" (I. p. 191).

We have, furthermore, repeated statements from our author to the effect that this indivisible something called consciousness can be split. "We shall find," he says, "in Chapter X, numerous proofs of the reality of this split-off condition of portions of consciousness" (I. p. 165). Again: "It must be admitted, therefore, that, in certain persons, at least, the total possible consciousness may be split into parts, which coexist but mutually ignore each other, and share the objects of knowledge between them" (p. 206); "How far this splitting up of the mind (consciousness) into separate consciousnesses may exist in each one of us is a problem" (p. 210); we "are forced to admit that a part of consciousness may sever its connections with other parts and yet continue to be" (p. 213); "Now although the *size* of a secondary self thus formed will depend upon the number of thoughts that are thus split off from the main consciousness, the *form* of it tends to personality, . . ." (p. 227). Are we really concerned here with an indecomposable unit? To conceive such a thing split into two or more parts of different sizes is indeed a difficult task. I can

think of only one way in which such a consciousness as Professor James supposes can be divided. It is granted time-parts (p. 279), and the fragmentary consciousnesses may, perhaps, divide these among themselves. This interpretation does not, however, adjust itself to the text at all, and it would be doing Professor James an injustice to foist it upon him.

The chapter on 'The Consciousness of Self,' although it contains occasional lapses into the 'indecomposable unity' idea, may yet be said to treat consciousness with fair consistency as a complex and decomposable thing. It has 'elements' and 'parts.' "Compared with this element of the stream," says our author, "the other parts, even of the subjective life, seem transient external possessions, of which each in turn can be disowned, whilst that which disowns them remains" (p. 297). As this element is "more incessantly there than any other single element of the mental life, the other elements end by seeming to accrete round it and to belong to it" (p. 298). The self under discussion is never found in the stream of consciousness all alone (p. 299); it is strongly contrasted with all the other things consciousness contains (p. 302).

It is unnecessary, I think, to multiply citations. The few that I have given are sufficiently direct and unambiguous. One might quote from almost any chapter—from that, for example, on attention, where we find such phrases as: "It is the simplest possible case of two discrepant concepts simultaneously occupying the mind" (p. 410); or from that on conception, where an image held before the mental eye is distinguished from the vague consciousness which surrounds it (p. 473). But as my object is illustration and not criticism, I shall quote but one more passage, which we may take as an apology (Professor James gives several such) for the expressions used in the citations already given. It reads as follows: "For the ordinary 'analytic' psychology, each sensibly discernible element of the object imagined is represented by its own separate idea, and the total object is imagined by a 'cluster' or 'gang' of ideas. We have seen abundant reason to reject this view. An imagined object, however complex, is at any one moment thought

in one idea, which is aware of all its qualities together. If I slip into the ordinary way of talking, and speak of various ideas 'combining,' the reader will understand that this is only for popularity and convenience, and he will not construe it into a concession to the atomistic theory in psychology" (II. p. 45).

Now far be it from me to insist that one may not, for convenience, speak with the vulgar, while thinking with the learned. It may be wise to do so on occasion. But it does not seem unreasonable to demand that the language one uses shall be capable of a translation into the tongue of the scholar when such a translation is asked for. In the present instance, I do not believe the thing can be done. I do not think Professor James could possibly say what he has said about mental phenomena and consistently use language which would treat consciousness as an indecomposable unit. As a philosopher he has accepted such a consciousness: as a psychologist he has fallen to the level of natural science and common-sense, and eschewed it completely. The interruptions from the philosopher introduce a disturbing element into the lucid expositions of the psychologist. One meets with difficulties which seem gratuitous. Much of the blame I should be inclined to lay on the shoulders of that unhappy intruder 'knowledge,' who seems to love darkness rather than light, and whose deeds may be more than suspected to be evil.*

* We may at least, with some confidence, accuse 'knowledge' of arbitrariness and unjust discrimination. We find that a consciousness cannot consist of a hundred feelings for the reason that each feeling is "shut in its own skin, windowless, ignorant of what other feelings are and mean" (I. p. 160). No feeling—being thus windowless and 'hide-bound'—can know another existent feeling. But a feeling (thought, consciousness) may know a material object which is not a feeling (p. 197); and it may also know another feeling, provided that other be non-existent—nay, in that case, it may even adopt it and hug it to itself (p. 340).

I am inclined to think that Professor James' treatment of consciousness is the result of a conspiracy between two quite distinct influences. We are almost tired of hearing from the apperceptionists that the contents of a consciousness must not be regarded as resembling a heap of wooden counters to which we may add, or from which we may subtract, a given number without causing any change in the rest. The notion of consciousness as an organic whole, and not an aggregate of changeless elements, is in the air, and deservedly receives emphasis. In the associational

The remedy for these ills appears to me to lie in a return to psychology as natural science. The excellence of Professor James' book—which I have chosen out of a large class for use as a text-book in the University of Pennsylvania—lies to a great degree in the fact that he does, in spite of himself, usually treat psychology as a natural science. It is easy to find fault with special points in almost any book, but it would be the extremest injustice to estimate a book after a consideration of such points alone. And I hope that what I have said will not be taken as an expression of opinion regarding Professor James' work as a whole. From many points of view I admire his volumes greatly.

VI.

I have developed my first point at such length that I cannot do more than mention a second. I must, however, mention it, for it seems to me of such importance that it should not be wholly passed over. Psychology as natural science must not merely assume a consciousness complex and capable of representing, in some intelligible sense of the word, an external world beyond it, but it must also recognize all conscious states to be mere phenomena, resolutely confine itself to phenomena, and, as science, eschew all metaphysical entities—'substrata,' 'unit-beings,' 'transcendental' selves, and what not. Whether one conceive conscious states as 'parallel' to brain states, or conceive of them as belonging with these latter to the one series

psychology which Professor James criticises ideas were much deader things than they are to us to-day, and I think his reaction against such a view of ideas very natural. But this influence alone would not have made him, I think, speak of consciousness as an indecomposable unity. The blame for this lies with his doctrine as to the nature of knowledge. If, when I perceive an object, I have, in addition to my percept, a 'knowledge' of the object, which gives me, somehow, the object known and the percept 'alongside' of each other, I may reduce my percept to a mathematical point if I choose, and yet go on talking about the parts of the object. The percept has become a useless thing. Its function has been usurped by 'knowledge.' I think that this is the real explanation of the fact that Professor James can speak of consciousness, even occasionally, as having no parts. He falls back on 'knowledge' for information which could not possibly be extorted from 'an uncompounded psychic thing.'

of causes, and determining physical movements, in either case one may study them from the natural-science point of view. They are in any case phenomena, which may be analyzed and described, and the relations of which to other phenomena may be determined by accepted scientific methods. The physiologist studies the phenomena presented by organized bodies without reference to any metaphysical 'substratum' or 'reality' underlying them, and so should the psychologist study the phenomena of mind. To him sensations, percepts, judgments, knowledge, the self, — everything he may find in a consciousness should be a phenomenon and nothing more, a conscious state or a component part of a conscious state. To divide mental phenomena into classes, and account for the one class by reference to that phenomenal something we call the brain, while referring the other to a 'self' not belonging to the world of phenomena at all, is surely unscientific. As well might the physiologist refer some of the phenomena of the human body to the 'substratum' granted it by the philosopher, holding explanation of them, in the ordinary sense of the word, inadmissible. The world of 'substrata' belongs to the metaphysician, if it belong to any one, and the psychologist will not gain by trespass. Let him stay on his own ground.

THE CASE OF JOHN BUNYAN. (II.)

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III.

"Now you must know," says Bunyan, "that before this I had taken much delight in Ringing,* but my *Conscience* beginning to be tender, I thought such practice was but vain, and therefore forced myself to leave it, yet my mind hankered. Wherefore I should go to the Steeple-house, and look on it, though I durst not ring. . . . But quickly after, I began to think, *How if one of the Bells should fall?* Then I chose to stand under a main Beam, that lay overthwart the Steeple, from side to side, thinking there I might stand sure. But then I should think again, Should the Bell fall with a swing, it might first hit the wall, and then rebounding upon me, might kill me for all this Beam. This made me stand in the Steeple-door; and now, thought I, I am safe enough; for, if a Bell should then fall I can slip out behind these thick Walls, and so be preserved notwithstanding. So after this I would yet go to see them ring, but would not go further than the Steeple-door. But then it came into my Head, How if the Steeple itself should fall? And this thought, it may fall for aught I know, when I stood and looked on, did continually so shake my mind that I durst not stand at the Steeple-door any longer, but was forced to flee for fear the Steeple should fall on my head."

The parallel between Bunyan's case and that of Dr. Cowles's patient, whose experience is so fully described in the

* I.e., of course, in ringing the chimes of the village church. Venables has skilfully pointed out, in various passages of Bunyan's writings, how deep a train of associations this practice later involved for the poet.

remarkable paper before cited, will from this point onwards become interesting to us. It is noteworthy that Dr. Cowles's patient, after some history of childhood fears, beginning at about ten years of age, became, for a time, 'well of these morbid experiences,'* but afterwards, in youth, experienced a fresh form of her previous disorder, and met this relapse at first in the form of 'feelings of hesitation in performing simple acts,' with a consequent necessity of repeating many such acts to be sure that they were right. 'From this point,' says Dr. Cowles of his patient, 'all the rest follows in its morbid train.' The fortunes of Bunyan were to be, up to a certain point, decidedly similar. The childhood period, with its warning terrors, had given place for a time to a healthy youth. But the elementary conscientious fears which now appeared, and which forced the lately reckless Bunyan to outward acts of unreasonable timidity, were soon to give place, as in Dr. Cowles s patient, to far more insistent and systematized impulses. In both of these cases the topics about which the insistent impulses finally systematized were matters of inner conscientious scruples. In both cases the general outward bearing and conduct long remained as far as possible normal, except where the inner sufferings of the patient must perforce break through and show themselves. In Bunyan's case it is interesting that these first signs of the coming storm were motor reflexes of a timid and partly of a morbidly inhibitory sort, produced irresistibly at the sound of those bells which he had so much loved to hear, and which, as Venables has shown by quotations from his later works, he never afterwards learned to forget.

The conversation of certain poor and godly people, about this time, revealed to Bunyan that, with all his legality, he had not yet learned what the true spiritual life is; and herewith began a second stage of his conversion. The consequence was much continuous meditation upon this higher religious life, and 'a softness and tenderness of Heart,' whereby his mind became 'fixed on Eternity,' and, for the time, refused 'to be taken from Heaven to Earth.' Theologi-

* Cowles, *loc. cit.* p. 238.

cal controversy with companions added itself to the foregoing to intensify Bunyan's interest in the secret of true faith. He now constantly read the Bible, which, however, to him, in his environment, seemed rather a collection of texts than of connected treatises. Henceforth his inner life was full of a not uncommon, but in his case especially significant, associative process, whereby he was largely at the mercy of any single text of his now well-thumbed Bible that at any moment might chance to occur to him, wholly separated, of course, from its context. He might be depressed. At such a time a threatening or discouraging text would come to mind; this or that Scripture would 'creep into his soul,' and wound him, or chill him all through. He could in but very small degree resist the effect of chance association by recalling the original relations or the meaning of this text as determined by its actual setting at the place where it occurs. No, this 'word' had come to him alone; alone he must interpret it and apply it to his case. Did its serious import overwhelm him? Then there was no way but to hunt at random, either in his Bible, or in the recesses of his chance associations, for some other 'word' to set over against the first. Then would follow very possibly long processes of this mere balancing of texts. One 'word' must be set against another, one set of texts must be neutralized by texts whose immediate emotional effects were more comforting. Bunyan also developed in connection with such tasks a peculiarly skilful sort of inner dialectic whereby he estimated the force of each text. He reasoned very subtly with these his own shadows. The decision of nearly every such crisis was determined in the end, however, less by the conscious dialectic itself than by the chances of association. At last, perhaps after days, in the later stages of his malady after months, of conflict, some decisive word would come to mind, would more or less irresistibly 'dart' into his soul, would even half seem to be spoken within him (a few times with the force of a pseudo-hallucination, and only once or twice with almost complete hallucinatory vigor). The 'word' that association thus made victorious might by its very clearness, or by the strength of its emotional setting, banish all the former

'words' from mind, and for the time doubts would leave him. Or again 'two Scriptures' would 'meet' in his heart, and one of them would triumph. This process is frequently exemplified in the *Grace Abounding*, and was of course largely determined, apart from the abnormal capriciousness of his associative processes, by Bunyan's religious opinions and com panionships. But this method of thinking was of course an inconvenient complication in view of his now imminent disorder.

At the stage of his pilgrimage now reached, he began to read Paul's epistles with eagerness. They did not decrease his dialectical tendencies. One day, when alone on the road, he found himself wondering gloomily, as he had been doing for some time, whether he really had saving faith or no. Whereupon the 'Tempter,' who of course, in our author's account, has to bear the responsibility for many of Bunyan's insistent impulses, and for a large part of his associative processes, suggested, as he had several times done before, that there was no way for Bunyan to prove that he had faith save by trying to work some miracle; "which Miracle at that time was this, I must say to the Puddles that were in the horse-pads, *Be dry*, and to the dry places, *Be you the Puddles*. And truly, one time I was going to say so indeed; but just as I was about to speak, this thought came into my mind, *But go under yonder Hedge and pray first that God would make you able*. But when I had concluded to pray, this came hot upon me, That if I prayed, and came again and tried to do it, and yet did nothing notwithstanding, then be sure I had no Faith, but was a Castaway and lost. Nay, thought I, if it be so, I will never try yet, but will stay a little longer."

In this account it is of course the hesitancy and the brooding, questioning attitude that is symptomatic, and not the logic of the quaint reasoning process, which, in view of Bunyan's presuppositions, is normal enough in form. To such broodings the dreamer added about this time one very elaborate symbolic inner vision of his unhappy state as related to the state of the godly people whose faith he envied. The vision, which, as reported, is a fine instance of the automatic visualizing process already characterized, need detain us here no

further. It is noteworthy that Bunyan reports it without any surprise, as an incident of a type very familiar in his inner life. The striving with chance Scripture passages continued, and now often drove him to his 'wit's end.' The comforting passages were occasionally hit upon, but only to give way soon to doubts. His questions as to what faith is, and whether he was of the elect, had already reached the limits of the normal. He was "greatly assaulted and perplexed, and was often," he says, "when I have been walking, ready to sink where I went with faintness in my mind." This is one of the few hints that we get of Bunyan's physical state at this time. The 'Tempter' was meanwhile quite capable of suggesting, as regards Bunyan's relation to his fellows in the faith, that these [viz., the known 'godly people' aforesaid] being converted already, "they were all that God would save in those parts; and that I came too late, for these had got the Blessing before I came." This thought was insistent enough to cause Bunyan great distress, and even anger at himself for having lost so much time in the past. After really desperate and lonely struggles with such wavering hopes, gloomy fears as to his salvation, and insistent questions and doubts on the whole subject, he at length forsook his solitude, and appealed for help to the 'godly people' themselves, who took him to their pastor, Mr. Gifford.

But herewith Gifford only made Bunyan's case for he time worse, by assuring him that he was a very grievous sinner, and by drawing his attention away from the universal problems about faith and election, back to the particular facts concerning the vanity of his wicked heart. The result was a new stage, wherein all the elements present in the two previous stages of his experience were morbidly combined, and the associative processes so inimical to his peace were rendered more automatic and systematic than ever. The first stage, it will be remembered, had been one of systematically insistent scrupulosity as to the details of his conduct, with elementary inhibitions and fears. The second stage had been one of large and more 'tender' emotional states, and of generalized broodings and doubts as to faith and election, accompanied with occasional feelings of general physical weakness

and faintness. But now this elaborate process of morbid training came to combine both generalized and specialized elements. The first effect was that instead of the 'longing after God' which had characterized the immediately previous state of mind, Bunyan now found in himself a perfect chaos of 'Lusts and Corruptions,' 'wicked thoughts and desires which I did not regard before.' He must 'hanker after every foolish vanity.' His heart "began to be careless both of my Soul and Heaven; it would now continually hang back, both to and in every duty; and was as a Clog to the Leg of a Bird to hinder her from flying. Nay, thought I, now I grow worse and worse; now am I further from Conversion than ever I was before. Wherefore I began to sink greatly in my Soul, and began to entertain such discouragement in my Heart as laid me low as Hell. If now I should have burned at the stake, I could not believe that Christ had love for me: alas, I could neither hear him, nor see him, nor feel him, nor savour any of his things. I was driven as with a Tempest; my Heart would be unclean; the Canaanites would dwell in the land." To this fairly classic description of his general state, Bunyan now adds for the first time a mention of the presence of insistent 'unbelief,' whereof we shall soon hear more. Meanwhile, however, as he adds in a most characteristic fashion: "As to the act of sinning, I was never more tender than now. I durst not take a pin or a stick, though but so big as a straw, for my conscience now was sore, and would smart at every touch; I could not now tell how to speak my words, for fear I should misplace them. Oh, how gingerly did I then go in all I did or said! I found myself as on a miry Bog that shook if I did but stir; and was as there left both of God and Christ and the Spirit, and all good things."

When a man has once got so far into the 'Slough of Despond' as this, there is indeed no way but to go on. Such insistent trains of morbid association cannot be mended until they first have grown worse. The process of systematization continued in this case, much as in that of Dr. Cowles's patient.* There were for Bunyan, to be sure, the occasional

* Cowles, *loc. cit.* pp. 240–45.

remissions due to the temporary success of this or that Scripture passage. So in one instance the effective suggestion came from without, through a sermon on the text, *Behold, thou art fair, my Love; behold, thou art fair*—a sermon whose pedantically multiplied headings Bunyan years later remembered with perfect clearness. As he was going home after the sermon the two words, *My Love*, came into his thoughts, and "I said thus in my heart, *What shall I get by thinking on these two words?*" Whereupon "the words began thus to kindle in my spirit, *Thou art my Love, thou art my Love*, twenty times together, and still as they ran thus in my mind, they waxed stronger and warmer, and began to make me look up. But being as yet between hope and fear, I replied in my heart, *But is it true?* At which that Sentence fell in upon me, *He wist not that it was true which was done by the angel.* Then I began to give place to the Word, which with power did over and over make this joyful sound within my soul, *Thou art my Love, thou art my Love; and nothing shall separate me from my Love;* and with that Romans eight, thirty-nine, came into my mind. Now was my heart full of comfort and hope, . . . yea, I was now so taken with the love and mercy of God that I could not tell how to contain till I got Home." But this mood of course proved to be unstable, and Bunyan soon "lost much of the life and savour of it."

"About a Week or a Fortnight after this," continues Bunyan, "I was much followed by this Scripture, *Simon, Simon, Satan hath desired to have you.* And sometimes it would sound so loud within me, yea, and as it were call so strongly after me, that once above all the rest, I turned my head over my shoulder, thinking verily that some Man had, behind me, called to me; being at a great distance, methought he called so loud." This pseudo-hallucination of hearing, secondary, be it noted, to the now frequent and insistent automatic motor process of internal speech, whereby Bunyan obviously found such texts forced upon his attention, concluded this special episode, and this particular text, as he expressly tells us, came no more. Hallucinations of hearing form no part of this case in any but this secondary, transient, and 'borderland' form—a fact, of course, which has to be clearly borne in mind in

estimating the phenomena. Later reflection, of a sort perfectly normal upon Bunyan's presuppositions, convinced him afterwards that this visitation was a heavenly warning that a 'cloud and a storm was coming down' upon him; but at the time he 'understood it not.' The minuteness of the account hereabouts is evidence both of the depth of the experiences, and of the remarkable intactness of Bunyan's memory amidst all this condition of irritable nervous instability of mood on the one hand, and of morbidly persistent brooding on the other.

IV.

But now for the culmination of the disorder,—a culmination which appeared in three successive and intensly interesting periods or stages, each one of which Bunyan narrates to us with extraordinary skill and vigor.

"About the space of a month after," he continues, "a very great storm came down upon me, which handled me twenty times worse than all I had met with before." Of this 'storm' the primary element, as we should now say, was a melancholic mood, of a depth and origin to him unaccountable. Former moods had been largely secondary, as would appear, to his doubts, although primary states of depression had also played their part. But this time the insistent impulses appeared as obviously quite secondary to the mood. The latter "came stealing upon me, now by one piece, then by another; first all my comfort was taken from me, then darkness seized upon me, after which" (the order is noteworthy) "whole floods of blasphemies, both against God, Christ, and the Scriptures, were poured upon my spirit, to my great confusion and astonishment. These blasphemous thoughts were such as also stirred up questions in me, against the very Being of God, and of his only beloved Son; as, whether there were, in truth, a God, or Christ, or no? And whether the holy Scriptures were not rather a fable, and cunning story, than the holy and pure Word of God? The tempter would also much assault me with this: *How can you tell but that the Turks had as good Scriptures to prove their Mahomet the Saviour as we have to prove*

our Jesus is? And could I think that so many ten thousands in so many Countries and Kingdoms, should be without the knowledge of the right way to Heaven (if indeed there were a heaven), and that we only who live in a corner of the Earth should alone be blessed therewith. Every one doth think his own religion rightest, both Jews and Moors and Pagans! And how if all our Faith, and Christ, and Scriptures should be but a Think-so too?"

Bunyan of course sought to argue with these doubts, but this expert in the dialectics of the inner life now very naturally found all the weapons in the enemy's hands. He would try using the 'sentences of blessed Paul' against the 'tempter.' But alas! it was Paul who had taught both Bunyan and the 'tempter' how to argue with subtlety, and now the reply at once came, in interrogative form: How if Paul too were a cunning deceiver, who had taken 'pains and travail to undo and destroy his fellows'? Bunyan's only remaining comfort was at this point the usual one of the patients afflicted with such harassing enemies. He was aware, namely, that he hated his own doubts, and was so, in a way, better than they. But, as he expressively words it: "This consideration I then only had when God gave me leave to swallow my Spittle; otherwise the noise and strength and force of these temptations would drown and overflow and as it were bury all such thoughts." Meanwhile insistent motor impulses of a still more specific sort occurred. Bunyan frequently felt himself tempted 'to curse and swear, or speak some grievous thing against God.' He compares his state to that of a child whom a gipsy is stealing and carrying away, 'under her apron,' 'from friend and country.' "Kick sometimes I did, and also shriek and cry; but yet I was bound in the wings of the temptation, and the wind would carry me away." Nor were the fears of hopeless insanity, so common in such patients, absent from Bunyan's mind, so far as his knowledge permitted him to formulate them. "I thought also of Saul, and of the evil spirit that did possess him; and did greatly fear that my condition was the same with that of his." The sin against the Holy Ghost was of course suggested to Bunyan's mind amongst other possible crimes, and it seemed at once, of course, as if he 'could not, must not, neither should be quiet' until he had

committed that. "Now, no sin would serve but that; if it were to be committed by speaking of such a word, then I have been as if my Mouth would have spoken that word, whether I would or no; and in so strong a measure was this temptation upon me, that often I have been ready to clasp my hand under my Chin, to hold my Mouth from opening; and to that end also I have had thoughts at other times, to leap downward into some muck-hill hole or other to keep my mouth from speaking."

But to follow further this chaos of motor processes is, for our purposes, hardly necessary. A system there indeed was amidst the chaos, but this system is now manifest enough. Suffice it that the whole race had now to be run. At prayer Bunyan was tempted to blaspheme, or the 'tempter' moved him with the thought, *Fall down and worship me.* At the sacraments of the church, which, although not yet a member of the church, he attended as spectator, in hope of comfort, he was also 'distressed with blasphemies.' There were still no true hallucinations, but "sometimes I have thoughts I should see the devil, nay, thought I have felt him, behind me, pluck my Clothes." As to mood, Bunyan was now usually 'hard of heart.' "If I would have given thousands of pounds for a Tear, I could not shed one; no, nor sometimes scarce desire to shed one." Others 'could mourn and lament their sin.' But he was, as he saw, alone among men, in this hardness of heart, as in the rest of his troubles. The unclean thoughts and blasphemies aforesaid were likely, as is obvious, to appear as reflexes, of an inhibitory type and meaning interestingly analogous to his earlier conscientious scruples themselves. For these blasphemies were excited by and opposed to any pious activity, precisely as the old conscientious fears had been excited by and inhibitory of any activity which his natural heart had most loved. Hearing or reading the Word would be sure, for instance, to bring to pass the blasphemous temptations. The 'tempter' was a sort of inverted conscience, busily insisting upon whatever was opposed to the pious intention. Meanwhile Bunyan of course complains of that general confusion of head of which all such sufferers are likely to speak. When he was reading, "sometimes my mind

our Jesus is? And could I think that so many ten thousands in so many Countries and Kingdoms, should be without the knowledge of the right way to Heaven (if indeed there were a heaven), and that we only who live in a corner of the Earth should alone be blessed therewith. Every one doth think his own religion rightest, both Jews and Moors and Pagans! And how if all our Faith, and Christ, and Scriptures should be but a Think-so too?"

Bunyan of course sought to argue with these doubts, but this expert in the dialectics of the inner life now very naturally found all the weapons in the enemy's hands. He would try using the 'sentences of blessed Paul' against the 'tempter.' But alas! it was Paul who had taught both Bunyan and the 'tempter' how to argue with subtlety, and now the reply at once came, in interrogative form: How if Paul too were a cunning deceiver, who had taken 'pains and travail to undo and destroy his fellows'? Bunyan's only remaining comfort was at this point the usual one of the patients afflicted with such harassing enemies. He was aware, namely, that he hated his own doubts, and was so, in a way, better than they. But, as he expressively words it: "This consideration I then only had when God gave me leave to swallow my Spittle; otherwise the noise and strength and force of these temptations would drown and overflow and as it were bury all such thoughts." Meanwhile insistent motor impulses of a still more specific sort occurred. Bunyan frequently felt himself tempted 'to curse and swear, or speak some grievous thing against God.' He compares his state to that of a child whom a gipsy is stealing and carrying away, 'under her apron,' 'from friend and country.' "Kick sometimes I did, and also shriek and cry; but yet I was bound in the wings of the temptation, and the wind would carry me away." Nor were the fears of hopeless insanity, so common in such patients, absent from Bunyan's mind, so far as his knowledge permitted him to formulate them. "I thought also of Saul, and of the evil spirit that did possess him; and did greatly fear that my condition was the same with that of his." The sin against the Holy Ghost was of course suggested to Bunyan's mind amongst other possible crimes, and it seemed at once, of course, as if he 'could not, must not, neither should be quiet' until he had

committed that. "Now, no sin would serve but that; if it were to be committed by speaking of such a word, then I have been as if my Mouth would have spoken that word, whether I would or no; and in so strong a measure was this temptation upon me, that often I have been ready to clasp my hand under my Chin, to hold my Mouth from opening; and to that end also I have had thoughts at other times, to leap downward into some muck-hill hole or other to keep my mouth from speaking."

But to follow further this chaos of motor processes is, for our purposes, hardly necessary. A system there indeed was amidst the chaos, but this system is now manifest enough. Suffice it that the whole race had now to be run. At prayer Bunyan was tempted to blaspheme, or the 'tempter' moved him with the thought, *Fall down and worship me.* At the sacraments of the church, which, although not yet a member of the church, he attended as spectator, in hope of comfort, he was also 'distressed with blasphemies.' There were still no true hallucinations, but "sometimes I have thoughts I should see the devil, nay, thought I have felt him, behind me, pluck my Clothes." As to mood, Bunyan was now usually 'hard of heart.' "If I would have given thousands of pounds for a Tear, I could not shed one; no, nor sometimes scarce desire to shed one." Others 'could mourn and lament their sin.' But he was, as he saw, alone among men, in this hardness of heart, as in the rest of his troubles. The unclean thoughts and blasphemies aforesaid were likely, as is obvious, to appear as reflexes, of an inhibitory type and meaning interestingly analogous to his earlier conscientious scruples themselves. For these blasphemies were excited by and opposed to any pious activity, precisely as the old conscientious fears had been excited by and inhibitory of any activity which his natural heart had most loved. Hearing or reading the Word would be sure, for instance, to bring to pass the blasphemous temptations. The 'tempter' was a sort of inverted conscience, busily insisting upon whatever was opposed to the pious intention. Meanwhile Bunyan of course complains of that general confusion of head of which all such sufferers are likely to speak. When he was reading, "sometimes my mind

would be so strangely snatched away and possessed with other things, that I have neither known, nor regarded, nor remembered so much as that sentence that but now I have read." This 'distraction' was often at prayer-time associated with insistent inner visual images, as of a 'Bull, a Besom, or the like,' to which Bunyan was tempted to pray.

Bunyan attributes to this condition an endurance of about a year. Detailed and obviously trustworthy as his psychological memory is, his chronology seems to suffer, very naturally, with a tendency to lengthen in memory the successive stages of his affliction. One can hardly find room, in the known period occupied by the entire experience, for such lengthy separate stages as the writer assumes. The present, or first culminating period of the malady, finally passed off by a gradual decline of the insistent symptoms,—a decline assisted, as would appear, by a controversial interest which Bunyan was just then led to take in the 'errors of the Quakers,' to whose condemnation he devotes a paragragh of his text, hereabouts, in his Autobiography. The objective turn which such controversial thoughts gave his mind was used, as he himself feels, by the Lord, to 'confirm' him.

One would suppose that the foregoing story, written with the most moving pathos by Bunyan, ought of itself to be a sufficiently obvious confession, even to readers of comparatively little psychological knowledge. The long-trained habits of verbal and emotional association which are exemplified in these repeated experiences with the remembered passages of Scripture, the systematized attitudes of conscientious fear and inhibition which date back to the beginning of our author's conversion, the obvious essential identity between all these mental habits, and those which Bunyan's 'tempter,' his inverted conscience,—equally fear-compelling, equally inhibitory of his present ardent desires,—represented, whenever this 'tempter' disturbed him at prayer, even as his conscience had in former days learned to disturb him at bell-ringing,—all these phenomena give us a most instructive object-lesson concerning the familiar processes by which the human brain, whether in health or in disorder, gets moulded. The emotional instability that lies at the basis of this particular morbid

process,—an instability without which, of course, just these habits could never have become such formidable enemies, is perfectly clear before us. Of the precise physical basis of this instability we can indeed only form conjectures; but we know that this was an extremely sensitive brain, and that the childhood dreams and terrors had been of a type such as to furnish obvious warnings that this mind needed especial care. We know too that such care was in so far lacking, as this still very young man had now to suffer the anxieties of providing for his family at a moment when his troubles about his soul were intense, and when his poverty was great. Meanwhile, one aspect of the symptoms, which we have already noticed, is as obvious as it has been, in the past, neglected by Bunyan's readers. This man, a born genius as to his whole range of language-functions, had been from the start a ready speaker, had developed in boyhood an abounding wealth of skilfully bad language, and had then, in terror-stricken repentance, suddenly devoted himself for many months to a merciless inhibition of every doubtful word. We observe now that insistent motor speech-functions were the most marked and distressing of his mental enemies, and that both the tempter, and that comforter whose strangely suggested Scripture passages occasionally consoled Bunyan's heart, tended to speak, 'as it were,' within the suffering soul. When one considers, still further, the careful way in which, by his own description, Bunyan excludes from his case all hallucinatory elements except the few pseudo-hallucinations, how can one doubt the type of patient with whom one has to deal? Memory, as one sees, is remarkably intact. Any tendency to pathological delusion is obviously lacking; for that Bunyan is beset by the 'tempter' is for him a mere statement of the obvious facts in the light of his accepted faith, and is, from his point of view, a strictly normal and inevitable hypothesis, which he never in any morbid fashion misuses. For the rest, he retains throughout as clearly critical an attitude towards his case as the situation in any wise permits; otherwise we should never have come to get this beautiful confession.

And yet, as said, the biographers have repeatedly missed nearly all these psychological aspects of the case, and that,

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too, whatever their theory of the poet's experiences. Some, as pointed out, have endeavored to conceive all this as merely the deep religious experience of an untutored genius. Religious experience it indeed was; nor does its deep human interest suffer from our recognition of its pathological character. Genius there also, indeed, is in every word of the written story. But the specific sequence of the symptoms thus recorded, and the striking parallel with such modern cases as that of Dr. Cowles's patient (who was surely no genius, and whose morbid conscience busied itself with far more earthly matters than the religious issues central in Bunyan's mind)—these things forbid us to doubt that the phenomena are characteristic of a pretty typical morbid process, which has certainly gone on in very many less exalted brains than was that of Bunyan. Other biographers have spoken, as Macaulay did, of 'fearful disorder,' but have had no sense of the clear difference between an hallucinatory delirium, which could only develop either in a very deeply intoxicated or exhausted, or else in a hopelessly wrecked brain, and a disorder such as this of Bunyan's, which could get thus dramatically systematized only in a sensitive but nevertheless extremely tough and highly organized brain, whose general functions were still largely intact. So sympathetic an observer as Froude, on the other hand, almost wholly ignoring the pathological aspect of the case, can actually suppose that Bunyan's 'doubts and misgivings' were 'suggested by a desire for truth'; because, forsooth, from the point of view of a nineteenth-century thinker: "No honest soul can look out upon the world, and see it as it really is, without the question rising in him whether there be any God that governs it all." Froude imagines, therefore, that Bunyan later went no further in doubt largely because 'critical investigation had not yet analyzed the historical construction of the sacred books.' But surely thus to argue is wholly to miss what it is that makes a given sort of questioning, or of other impulse, normal or morbid, for a given man, and under given circumstances. And here is perhaps the place to define more precisely this very matter in our own way.

Morbidly insistent impulses, of whatever sort, are, oddly enough, never morbid merely because they insist. For all our most normal impulses are, or may become, insistent. One has a constantly insistent impulse to breathe, a frequently insistent impulse to eat; and one's life depends upon just such insistences. Insistent desires keep us in love with our work, take us daily about our duties, guide our steps back to our homes, seat us in our chairs to rest, are with us, in their due order, from morning to night, whether we bathe, dress, walk, speak, write, or go to bed. To run counter to such normally insistent impulses pains, and may in extreme cases very greatly distress, or even in the end quite demoralize us. Insistence of will-functions is, then, so far, a sign of health, and means only the kindly might of sound habit. An 'imperative impulse' of the morbid sort is therefore, in the first place, one that, under the circumstances, opposes instead of helping our normal process of 'adjustment to our environment.' But herewith we have still only defined, so far, that element of the morbid impulse which the latter shares in common with all defective mental processes. The peculiar *differentia*, however, of all the various forms of morbidly insistent thoughts, fears, temptations, etc., is that their tendency to bring one out of 'harmony with his environment' is subjectively expressed, for the sufferer himself, in the form of a sense that the fear, thought, or other impulse in question is opposed to his fitting relation to his environment *as he himself conceives that relation.* The hallucination or the delusion gives one a pathologically falsified environment, and then one's adjustment objectively fails, because one knows not rightly the truth to which one ought to be adjusted. Confusedness, or mere incoherence of ideas and impulses, or other such general alteration of consciousness, equally means failure, but here also without any completer subjective sense of what one's failure objectively involves. But the sufferer from morbidly insistent impulses, whether or no he conceives his environment rightly, still knows how he conceives it, and has his general plans of thought and will; but he himself, meanwhile, finds, within himself, 'in his members,' 'another law warring against the law' which he has accepted as his own. Without pretty defi-

nite plans, then, there can be no morbidly insistent impulses. Failure, or strong tendency to failure, in the adjustment, as conceived and planned by the sufferer himself,—such failure being due to this inner conflict,—this it is alone that makes us speak of morbidly insistent impulses.

But not even thus do we define all that it is necessary to bear in mind in judging such cases. Impulses, feelings, thoughts, more or less inimical to our deliberate plans, are constantly, if but faintly, suggested to us, by our normal overwealth of perceptions and of associations. Without such overwealth of offered perceptions and associations, we should not have sufficient material for mental selection; yet such overwealth is necessarily full of solicitations, tempting us, with greater or less clearness, to abandon or to interrupt our chosen plans of action. Nor is there any fixed limit to the range of those 'imaginations as one would,' that, as Hobbes already pointed out, may at any moment be initiated in a man's inner life by chance experience and association. Therefore, mere opposition between our chance impulses and our plans is a perfectly normal experience.

Normal impulses then are insistent. And normal trains of impulse, or plans of conduct, are constantly besieged by the faint but more or less inimical distractions of normal experience. When, then, is any single impulse, as such, abnormal? When it insists? No, for breathing is an insistent impulse. When it opposes the current trains of coherent thought or volition? No, for every momentary inner or outer distraction tends to do that; and there is hardly any known impulse or thought or feeling of which a normal man may not at almost any moment be reminded, through the chances of perception and of association. What then is the subjective test of the abnormal in impulse? One can only find it in this: Association chances to suggest any impulse inimical to one's actually chosen plans for 'adjustment to the environment.' So far there is no essential defect. This happens to anybody. But normally the coherence of one's series of healthily insistent or of voluntary impulses is so great, or the strength of the intruder soon becomes, under the influence of the opposed ruling interests,

so faint, that this intruder is erelong sent below the level of consciousness, or harmlessly 'segmented,' and that with an ease and a speed proportioned to the incongruity and to the felt inconvenience of this enemy itself. But, in the abnormal cases, things go otherwise. Perhaps the intruding impulse is not a chance one, but is itself part of a previously established system of inhibitory habits. Or perhaps it is supported by numerous now partly or wholly unconscious motives, say by masses of internal bodily sensations (as in case of pathological fears or of certain physical temptations of abnormal vigor). In all such cases it may prove too strong to be controlled. Or again, the general condition of the sufferer is one of irritable weakness. The sustained coherence of normal functions is then already impaired by nervous exhaustion; the main trains of association hang weakly together; their general power of resistance, so to speak, is lowered. The intruding impulse, on the contrary, is then the mental aspect of a suggested nervous excitement that, beginning at one point, quickly spreads to others, and for the time takes possession of the functions of this unstable brain. And now, in any of these cases, we have a failure to resist the intruder, a failure which the sufferer himself bitterly feels. Objectively the failing adjustment appears as hesitation, or as useless repetition of acts, or as unaccountable impulsive 'queerness' of conduct, or even as helpless inactivity, with various quasi-melancholic symptoms,—silence, hiding, self-reproach, lamentation. Within, the sufferer, who, to suffer decidedly from this sort of malady must be a person of highly organized plans and of self-observant intelligence, feels a prodigious struggle going on. All seems to him activity, warfare, self-division, tumult.

In judging of such a case, one must therefore carefully avoid being deceived either by the imperativeness or by the quaintness of the particular impulses involved. All depends upon their relations in a man's mental life. The intense interests of the inventor, of the man of science, of the rapt public speaker, are not necessarily at all analogous to the 'obsessions' of the sufferer from insistent impulses, although the former are, like breathing, imperative. Nor are the

merrily absurd impulses of a gay party of young people at a picnic abnormal, merely because they are for the time incoherent, and are thus opposed to serious thought and conduct. No, it is the *union* of a tendency towards incoherence in feeling and conduct, with an imperative resistance to the actual and conscious plans, whereby the sufferer deliberately intends to be in some chosen fashion coherent,—it is this union of incongruity with insistence that constitutes the subjective note of the morbidly insistent impulse.

These are commonplace considerations. I should not introduce them here, were not the literature of this whole topic so often affected by confusions of conception. In the light of such obvious considerations, Froude's refusal to see the abnormity of Bunyan's insistent questions or 'blasphemies' as to the being of God, and the like, becomes sufficiently insignificant as affecting our present judgment. Any man may by chance, in his mind, come momentarily to question anything. That is so far a matter of passing association, and involves nothing suspicious. A modern or, for that matter, an ancient thinker may moreover persistently question God's existence. If the thinker is a philosopher, or other theoretical inquirer, such doubts may form part of his general plans, and may so be as healthy in character as any other forms of intellectual considerateness. But if a man's whole inner life, in so far as it is coherent, is built upon a system of plans and of faiths which involve as part of themselves the steadfast principle that to doubt God's existence is horrible blasphemy, and if, nevertheless, after a fearful fit of darkness, such a man finds, amidst 'whole floods' of other 'blasphemies,' doubts about God not only suddenly forced upon him, but persistent despite his horror and his struggles, then it is vain for a trained sceptic of another age to pretend an enlightened sympathy, and to say to this agonized nervous patient: 'Doubt? Why, I have doubted God's existence too.' The ducklings can safely swim, but that does not make their conduct more congruous with the plans and the feelings of the hen. The professional doubters may normally doubt. But that does not make doubt less a malady in those who suffer from it, and strive, and cry out, but cannot get free.

This observation, that the symptomatic value of these insistent impulses lies solely in the *relation* between the impulses themselves and the organized mental life, the plans, insight, and chosen habits of the patient, reminds us also in this case that Bunyan's experiences clearly indicate the essential psychological equivalence of several of the various sorts of *manias* and *phobias* which some authors, imagining that the content rather than the relations of the impulses concerned is important, have so needlessly chosen to distinguish. Bunyan was tempted to doubt, fear, question, blaspheme, curse, swear, pray to the devil, or to do whatever else conscientious inhibition and irritably weak speech functions had prepared him to find peculiarly fascinating and horrible. There was no importance in the mere variety of the wicked ideas that the one 'tempter' suggested. The evil lay in the systematized character of the morbid habits involved, and in the exhausting multitude of the tempter's assaults.

(*To be concluded.*)

COMMUNITY AND ASSOCIATION OF IDEAS: A STATISTICAL STUDY.

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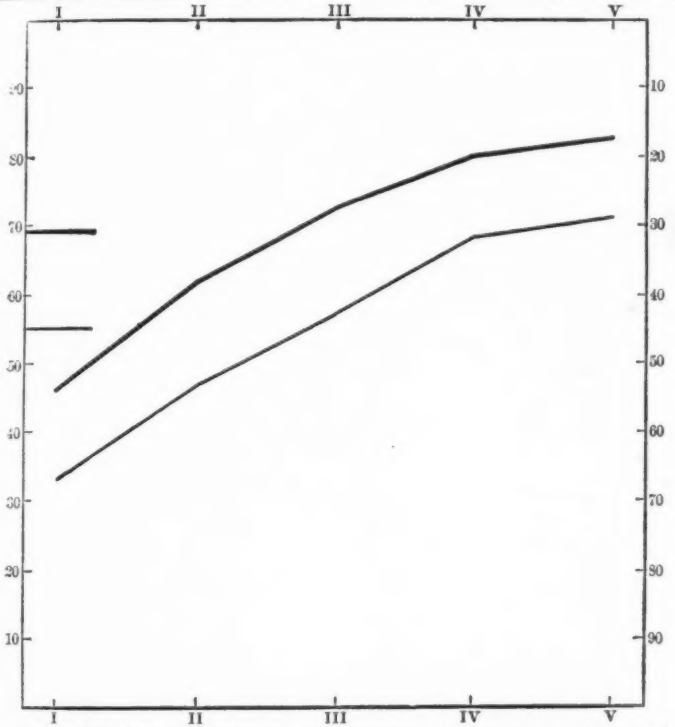
The application of statistics to the study of mental phenomena promises to supply the data for new and suggestive generalizations, as well as to corroborate, often in an unexpected manner, the laws of mind derived from off-hand observation. The census and newspaper statistics on matters large and small have familiarized us with the notion that facts which separately may have but little importance, when considered in groups give rise to significant truths. In the hope of contributing to our knowledge of the nature and regularity of such mental processes, I have upon various occasions requested a class of students to serve as the subjects of experiment.* In the test here to be described a word was written upon the blackboard and, by the withdrawal of a screen, was shown to the whole class at the same moment; each student thereupon wrote as rapidly as possible *the five words first suggested to him* by the word upon the board. In this way five associations were obtained from each student to each of the following ten words: *book, man, tree, cat, hand, hat, bread, pen, write, blue.* By counting separately for each of the five associations how often different students have written the same word we may determine the degree of similarity of their associations, and further how this community of ideas varies as the associations recede from their common starting-point. The result of this enumeration appears in the following table.

This table is based upon 69† lists of words, theoretically

* One of these tests is described in *A Study in Mental Statistics* (New Review, December 1891) and another in *A Statistical Study of Memory and Association* (Educational Review, December 1891).

† This number is too small to establish beyond the influence of chance detailed conclusions; the conclusions most firmly established and those simply suggested or made probable are indicated as they occur.

	First Word.	Second Word.	Third Word.	Fourth Word.	Fifth Word.	Total.
Number of different words ...	307	414	480	522	515	2278
Percentage of " " ...	46.2	62.1	72.7	80.1	82.8	69.8
Number of 'unique' words...	222	313	377	447	442	1801
Percentage of " " ...	33.4	47.2	57.1	68.5	71.1	55.2
Total number of words.....	665	663	660	652	622	3262



Curves showing the relation of the community of ideas to the 'distance' in associated words from the original suggesting word. I, II, III, IV, V, represent the first, second, third, fourth, and fifth association to a given word; the vertical distances to the intersections of the heavy curve with these lines when measured from below represent the percentages of *different* words, when measured from above, the percentages of *same* words in the entire list of first, second, third, fourth, and fifth associated words respectively. The lighter curve represents the same relations for the percentages of words occurring but once in the same position on the entire lists. The short marks to the left represent the mean values of each curve.

of 50 words each, but actually containing in all 3262 words. In the first line of the table appear the number of different words written as the first, second, third, fourth, and fifth associations respectively, with their sum total; in the second line these numbers are expressed in percentages of the total number of words written, which in turn are given in the lowest line of the table. A second indication of the community of ideas may be obtained from the proportion of associations written by but one person of the entire 69; these once-occurring or 'unique' words are tabulated in precisely the same way as the number of different words and appear in the third and fourth lines of the table.

The significance of these numbers appears most clearly in a graphic presentation; we see at a glance how regularly *the proportion of different words, as also of unique or once-used words, increases as the associations proceed.* There is most community of ideas amongst the first associations to a given word, distinctly less community amongst the second associations, and progressively less, on to the fifth. The greatest difference is between the first and second associations, the differences decreasing with successive associations. The complete parallelism between the proportions of different and of unique words is also striking. The divergence of mental paths from a common centre, the appearance of individuality and disappearance of community of ideas, are thus clearly exhibited; and the result is important as well for its psychological bearings as for its testimony to the value of the statistical method in psychological investigations.*

It is always interesting to compare the mental processes of men and women. Former investigations have indicated that

* These results invite comparison with those of the former study; the percentage of different words for the first associated words is here 46.2; in the former study 34.4; of 'unique' words 33.4 and in the former study 20.0, the number of lists being the same in the two cases. This would indicate a greater amount of individuality in the contributors to this than in those to the former study. As above recorded, the same association occurring in two different positions is counted as two; if counted as one only, that is, irrespective of position, the percentage of different words becomes 45.7, and of 'unique' words 31.3; a comparison of these with the former averages, 69.8% and 55.2%, indicates that 24.1% of all the words recur in different positions and that 23.9% of words occur but once in one position, but again in other positions.

in unrestricted and extended series of associations such as the writing of the first one hundred words thought of, women repeat one another's ideas more frequently (in one result about 25% more frequently) than men. When the suggesting word was supplied no noteworthy difference between the sexes appeared, regarding the community of ideas amongst the first suggested words. In the present study two entirely different groups of nineteen men were selected by chance for comparison with the nineteen women who took part in the test. The result of the comparison appears in the accompanying table.

		1st Word.	2d Word.	3d Word.	4th Word.	5th Word.	Total.
Percentage of different words	Women.....	70.4	85.8	87.4	92.1	96.5	86.2
	Men: Group A	65.0	81.5	87.4	90.7	93.5	84.5
	Men: Group B	59.7	81.8	87.6	90.8	92.9	82.5
Percentage of 'unique' words	Women.....	40.3	53.0	56.3	72.5	77.8	59.6
	Men: Group A	32.8	45.7	60.1	67.0	68.0	54.5
	Men: Group B	31.2	47.6	56.4	67.0	68.5	54.1

It will be seen that in all but the third word and in both the proportion of different and of 'unique' words there is less community of associations amongst the women. This result, however, is based upon too limited data to be accepted as final, and there are indications that the associations of these nineteen women have unusually little in common.

With regard to the difference in tendency amongst the ten words to suggest the same associations, it appears, as a result of various modes of measuring them, that *blue*, *cat*, and *pen* are most apt to suggest the same words to different persons, *hand*, *book*, and *man* least apt to do so, while *tree*, *hat*, *write*, and *bread* present an average tendency in this respect.

The most frequent associations with the number of their occurrences without regard to place are: *pen—ink*, 43; *hand—finger*, 31; *blue—sky*, 30; *tree—leaf*, 29; *blue—green*, 28; *cat—dog*, 28; *pen—paper*, 27; *bread—butter*, 27; *blue—red*, 27; *man—woman*, 26; *cat—mouse*, 25; *pen—write*, 24; *write—pen*, 24.

It remains to investigate the *nature* of the associations.

For this purpose a classification followed in a former study and suggested by an analysis of the associations themselves may be adopted. (I) Whole to Part, or General to Special, such as *tree—leaf* or *tree—oak;* (II) Part to Whole, or Special to General, as *hand—arm, blue—color;* (III) Object to Activity, as *pen—write;* (IV) Activity to Object, as *write—pen;* (V) Object to Quality, as *tree—green;* (VI) Quality to Object, as *blue—sky;* (VII) by Natural Kind or one object suggesting another of the same class, as *cat—dog*, both being names of animals, as *bread* suggests other articles of food, *blue* other colors, and the like; (VIII) by Similarity of Sound, as *man —can, write—height;* (IX) Miscellaneous, including all that are ambiguous or not readily classified.

The distribution of the associations amongst the nine types appears in the table; the percentages of each kind of association both in general and for each position separately are likewise given.

	I	II	III	IV	V	VI	VII	VIII	IX
Total.....	15.6	2.8	6.2	5.2	14.9	3.3	24.4	10.9	16.7
1st assoc...	17.1	6.0	4.8	6.0	11.3	2.5	34.3	9.5	8.5
2d assoc....	18.3	2.9	6.6	5.5	12.9	3.0	28.3	9.7	12.8
3d assoc....	14.2	2.1	6.2	6.1	16.4	3.9	22.9	10.7	17.5
4th assoc...	15.2	1.2	8.1	4.4	17.8	3.6	18.8	11.9	19.0
5th assoc...	13.2	1.8	5.3	4.2	16.4	3.2	16.7	12.9	26.3

The types of associations found to be prominent in the former study are also prominent in this; the most frequent associations are those by Natural Kind, while those from Whole to Part and from Object to Quality are also prominent. Associations in one direction may be more frequent than in the reverse direction—Whole to Part more frequent than Part to Whole, and the like.

In the change in distribution of the associations in the several positions, it is possible to distinguish certain significant

tendencies; more extended data would be necessary to establish completely the relations involved. The two most regular and prominent changes are the decrease of associations by Natural Kind, and the increase of Miscellaneous associations as the associations proceed; the one decreases by regular steps from 34.3% to 16.7%, and the other increases from 8.5% to 26.3% of all the associations. Associations by Natural Kind are simple, while those termed Miscellaneous are thus indicated as variable and unusual; it appears then that the simple associations are exhausted before the more remote ones are thought of. This conclusion reinforces from a new point of view the result formulated in the general curve; the percentage of common words decreases at the same time that the nature of association varies; *it is a variation of types of association as well as of words.* Furthermore, by calculating the proportion of different as also of 'unique' words among the associations by Natural Kind without regard to position, we find only 25.6% and 10.5%, as against 45.7% and 31.3% for all associations in general—certainly a marked contrast.

The next table furnishes the data for comparing the distribution of the various kinds of association among men and women; it is formed just as was the former table, but the smallness of the numbers emphasizes the necessity of great caution in drawing deductions. Masculine preferences appear to be for associations by Sound, from Whole to Part, from Object to Activity from Activity to Object, and also for those by Natural Kind. Feminine preferences are for associations from Part to Whole, from Object to Quality, Quality to Object, and Miscellaneous. These differences are in general in accord with those formerly established and may be brought into relation with recognized differences in the mental processes of men and women.

A word should be added regarding the method of classifying and counting these associations. Inasmuch as no restrictions were imposed upon the words to be written it was left open whether the five words should all be associated with the original word, or the second word be suggested by the first, the third by the second, and so on, with little or no thought of the original word. After due consideration the former plan

		I	II	III	IV	V	VI	VII	VIII	IX
Total	M	16.7	2.6	6.6	5.4	13.6	3.0	26.0	12.4	13.7
	F	12.7	3.5	5.2	4.8	18.2	4.0	20.2	7.0	24.4
1st assoc.	M	16.4	5.8	4.9	6.0	9.3	2.5	36.3	11.4	7.4
	F	18.8	6.5	4.3	5.9	16.2	3.2	29.0	4.8	11.3
2d assoc.	M	19.1	2.2	6.6	5.5	11.1	3.0	30.4	11.7	10.4
	F	16.2	4.9	6.4	5.4	17.7	3.2	23.1	4.9	18.2
3d assoc.	M	16.4	2.3	6.7	5.7	14.2	4.4	23.5	12.8	14.0
	F	8.7	1.6	4.9	7.1	21.8	2.7	21.2	5.4	26.6
4th assoc.	M	17.1	0.9	9.3	5.2	17.3	3.0	20.1	12.6	14.5
	F	10.1	2.2	5.1	2.2	19.1	5.1	15.2	10.1	30.9
5th assoc.	M	14.7	1.6	5.6	4.4	16.4	2.3	18.7	13.6	22.7
	F	9.3	2.3	4.0	3.5	16.3	5.8	11.7	10.5	36.0

was adopted as following more closely than the other the natural order of thought. A large majority of associations are either clearly associated with the original word, or are capable of either interpretation; the thought rarely wandering entirely or far away from the original word. It is estimated that in not more than five per cent of the words is the association clearly with the preceding and *not* with the original word. Typical instances of such associations are: *Bread, cow, milk, pitcher, crockery; Write, letter, home, brother, vacation, school; Cat, mouse, trap, cheese, poison, death.* With more than five associations to each word it would undoubtedly be necessary to recognize more completely this difference in the nature of the associations, whether serial like the links of a chain, or radiating like the spokes of a wheel.

ON REACTION-TIMES AND THE VELOCITY OF THE NERVOUS IMPULSE.*

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Our object was to determine the conditions which affect the length of reaction-times on dermal stimuli, and to study the application of the reaction-time to the measurement of the velocity of the nervous impulse in motor and sensory nerves, and in the motor and sensory tracts of the spinal cord.

Sec. 1. *Apparatus and Methods.*—In order to measure a reaction-time at least three instruments are required—one to give the stimulus and record the instant at which it is given, one to record the instant at which a movement is made, and one to measure the intervening time. We used the Hipp electric chronoscope for measuring the time, having made several improvements in its construction and regulation. With our apparatus we could measure the time of a reaction with a variable error of about 1σ (i.e. one thousandth of a sec.), and a constant error of about the same size. The variable error is practically eliminated in the average of 100 measurements, and the constant error is practically eliminated when a difference is taken. We used various methods to apply an electric shock or a blow to the skin. In the case of a blow we were able to measure exactly its force. The greater part of the apparatus was secured through an appropriation from the Bache Fund, and is the property of the National Academy of Sciences.

* Abstract of a paper presented before the meeting of the National Academy of Sciences, Albany, 1893. The paper with description of apparatus, tabulated results, and historical references will be printed in the *Memoirs of the Academy*.

We made 10 reactions in a series and 10 series in a set, each time given in the Tables being the average of 100 reactions. We give the mean variation of the separate reactions and of the separate series and probable errors when it seems needful. The mean variation of the separate reactions is on the average about 10σ, and the probable error of the figures given in the Tables would be about 1σ. Although we omitted no measurements in calculating the averages, the probable errors are much smaller than in previous investigations on reaction-times. In some cases we made 10 reactions in succession at intervals of 2 sec., and only measured the resultant time. By this method more reactions can be made in a given time, but the probable error of the single reactions is not known.

The experiments were begun in 1889 in the psychological laboratory of the University of Pennsylvania and completed in 1893 at Columbia College. The experiments were made by D and C (the writers) and J, all of whom were used to scientific work.

Sec. 2. *Reactions on Electrical Stimuli.*—An electric shock can be applied conveniently to different parts of the body. The shock may be made as strong as desired and the moment of its occurrence registered. We used electrodes of various sorts. The method we found best was to apply one electrode (usually a platinum surface 10 mm in diameter) to the points on the skin which we wished to stimulate, while the other electrode was conducted to a pail of saturated salt water in which the left foot was placed. The stimulus was given 10 times in succession at the same point, and then immediately switched to another point without shifting the electrodes The shock was usually given on the left-hand side of the body, the reaction being made with the right hand or foot.

The sensory effects of electrical stimulation of the skin have not been properly investigated, and this is the more curious as the effects on the organs of sight, hearing, taste, and smell have been thoroughly studied. With a galvanic current from 28 cells in pairs we found a decided difference in sensation according to the pole with which the electrode was connected. Thus when the positive pole was applied

to the outside of the upper lip (the other pole being conducted to the foot) there was a prickling sensation, a strong taste and a flash of light, the prickling and taste continued while the current was closed and there was a flash of light on breaking. When the negative pole was applied to the same point there was a slight shock and flash of light and no taste, but sensations of piercing and boring followed which were unendurably painful. The current caused tetanus of the muscle and left blisters. This experiment shows that the current from the negative pole was more intense and from the positive pole more diffused (extending with much energy to the organs of taste and sight), which indicates that the current passes through the body from negative to positive pole.

We used in our experiments the momentary shock following breaking of the primary circuit. The same objective current does not give a shock of the same subjective quality and intensity when applied to different parts of the body. The sensation is more piercing when the electrode is applied close to the nerve, and more massive (as from a blow) when there is muscle intervening. The sensation of a shock from 8 cells on the upper arm might be as intense as that from 28 cells on the wrist. The shock from the same current also varied with the pressure of the electrode and especially with the moisture of the skin. Further as the experiments proceeded the part of the skin to which the shock was applied became continually more sensitive. The shock is more piercing from a small electrode and more massive from a large electrode.

We have made so many experiments (more than twenty-four thousand reactions) and with such numerous variations in the place of applying the stimulus, and in the nature of the stimulus and of the movement, that we fear an abstract of our results will be somewhat confusing. The details could only be properly understood from the Tables, and a study of these will only be undertaken by those especially interested in research in this direction.

In our first experiments we chose four points on the skin for the application of the stimulus. These were permanently fixed by pricking the skin and introducing nitrate of silver.

Two of the points were on the arm over the median nerve, and two on the leg over the posterior tibial nerve. The points on the arm were 30 cm apart and those on the leg 50 cm apart, and the length of intervening nerve would be nearly the same. To stimulation of these points 5360 reactions were made, the movement being made in two thirds of the cases with the hand and in one third with the foot.

The reaction-time was the shortest when the stimulus was applied to the upper arm and the movement made with the hand. The time was 149.6σ for D and 113.1σ for C, about $\frac{1}{7}$ and $\frac{1}{9}$ sec. respectively. Such a personal difference must be due either to differences in the nature of the process or to differences in the sensitiveness of the parts of the nervous system concerned. The variation from time to time is much greater than can be due to chance variations, and the differences must measure secular changes in the nervous system.

When the stimulus was applied to the lower arm or on the leg the reaction-time was longer, the excess of time for the lower arm being 14.2σ for D and 6.9σ for C. The lower point was 30 cm furtner from the brain than the upper point, and if we could assume the difference in time to be due to the difference in length of the nerve travelled we should have a velocity of the impulse in the sensory nerve of 21.1 m per sec. for D and 49.5 m per sec. for C. The velocity in the sensory fibres of the posterior tibial nerve would be 31.1 m per sec. for D and 64.9 m per sec. for C. We are not, however, prepared to accept these velocities as valid. The differences in the time of reaction are undoubtedly correct, the variable error being practically eliminated. But the variation of the two observers and of the same observer at different times are so considerable, that we think these must be attributed to differences in the cerebral processes rather than to differences in the velocity of the impulse in the sensory nerve. The shorter reactions on the upper point might be due to other causes than nearness to the brain, such as to greater intensity.

When the shock was applied to the leg in one case, and to the arm in the other, the impulse in the former case had in addition to travel through the spinal cord from the lumbar to

the brachial plexus, and the times are considerably longer. The differences when the movement was made with the hand were 26σ for D and 27.1σ for C. When, however, the movement was made with the foot the differences were 18.4σ for D and 18.7σ for C. The excess of distance in the spinal cord was the same as before, but the times were about 8σ shorter. We thus show that when the stimulus is applied to the left leg the cerebral reflex is relatively shorter to the right foot, and when applied to the left arm is relatively shorter to the right hand. The sensory fibres from one part of the body are most closely connected with the motor fibres to the same part. If we may assume that the cerebral reflex occupied the same time in the cases compared we should have a velocity in the motor tracts of the spinal cord of about 15 m per sec., and we may at least assume that the velocity is not less than this.

When the movement was made with the foot in one case and with the hand in the other, the stimulus being applied to the arm, the excess of time with the foot was 37.7σ for D and 54.4σ for C. When the stimulus was applied to the leg the differences were less (8.5σ for D and 9.4σ for C). We have thus again measured the difference in time of the cerebral reflex when the motor impulse proceeds to the part of the body from which the sensory impulse arrives and when it proceeds to a different part.

The difference in the time when the reaction is made with the hand and foot, respectively, is partly due to the time required to traverse the motor tracts of the spinal cord, but it may also be due to differences in the cerebral processes. The cerebral reflex is undoubtedly less perfect to the foot than to the hand. The difference in the case of the two observers is almost certainly a difference in the cerebral process. C's reaction with the hand is very automatic, with the foot it is more nearly like D's. If the whole excess of time in the case of D were consumed in traversing the motor tracts of the cord between the brachial and lumbar plexus we should have a velocity of about 10 m per sec. In so far as we can accept these results, the velocity in the sensory tracts of the cord would be greater than in the motor tracts, and this could be

explained by a partial co-ordination of the movement in the cord.

As the differences found might be due to varying intensity of the shock or differences in the cerebral reflex, we made a large number of reactions (10,400) with a view to studying these factors. After some diverse experiments which will be found in our paper, we chose four points on the arm, and in some of the experiments used three intensities of shock. Two of the points were the same as before, but we chose an additional point on the lower arm near the wrist the stimulation of which was followed by muscular contractions and a massive sensation, and a point on the middle arm the stimulation of which was followed by a prickling or piercing sensation. We had thus two points on the lower arm close together, the stimulation of one giving a strong and massive sensation, the stimulation of the other giving a weaker and more prickling sensation. On the mid-arm the stimulation was followed by a prickling sensation, on the upper arm by a massive sensation. As a result of our experiments we found that the time of reaction was shorter when the intensity of sensation was greater, whether the increase in intensity were due to a stronger objective shock or to greater physiological effect on different points from the same shock. Thus as the final result of 1200 reactions on each point (made by J and C), we found the time on the lower point giving the massive sensation to be 126.6σ, and on the upper point giving a similar sensation to be 126.8σ, almost exactly the same. We must therefore conclude that the time of transmission in the nerve was exactly counterbalanced by a shorter cerebral reflex in the case of the point further from the brain. In the case of C the subjective intensity of the shock was greatest on the upper point and the final time was 2.2σ shorter on this point. In the case of J the subjective sensation was stronger on the lower point and the time was 2.4σ shorter. These differences are so small that the velocity of the impulse was not counterbalanced by any difference in intensity in favor of the lower point, but we conclude that the cerebral reflex is shorter when the stimulus is applied to a point near the hand, the movement being made with the hand on the opposite side of the body. The sensory fibres

from one part of the body are most closely connected with the motor fibres to a corresponding part.

When the same stimulus was applied to two points on the arm nearly equidistant from the brain but accompanied by different sensations, the reaction-time was 10.2σ shorter on the point for which the sensation was the stronger. When it was applied to the point on the lower arm and to the point on the mid-arm giving nearly the same sensation, the times differed by only 0.6σ.

When three intensities of shock were used, the time of reaction was on the average 19.6σ shorter for a very strong shock than for a medium shock, and 9.8σ shorter for the medium shock than for the weak shock. But the physiological intensities of the shocks could not be measured. The reaction times were nearly the same for the two observers (J, 127.4σ and C, 128.3σ) when the shock was strong, but were longer for C when the shocks were very weak.

When the size of the electrode was altered the difference in the length of the reaction-time seemed due to the intensity only. The time was also nearly the same when the shock was applied from electrodes 5 cm apart, when the current was sent through the limb, and when it was sent through the entire body.

When the attention was directed alternately to the stimulus and to the movement no difference in reaction-time was found for J and C, but D's reaction-time was longer when the attention was directed to the movement, he being in the habit of attending to the stimulus. When the reaction-time is short and regular the amount and direction of the attention does not materially affect the time of reaction; but when the process is less reflex, it may be lengthened by an unusual direction of attention.

The reaction-time was shorter (J, 18.9σ, C, 14.2σ) when the shock is applied to the hand with which the movement is made than when it is applied to the other hand. This might be expected, as the movement is a natural reflex—a person will without reflection withdraw the hand when it touches a hot object. The fact is of interest in connection with the results already noticed, which show that the cerebral reflex is

in general quicker when the sensory fibres stimulated are from the same part of the body as that with which the movement is made.

The reaction-time is longer when the movement is made from the shoulder, and nearly the same when it is made from the fore-arm, wrist, or finger. This shows that when the movement is made with the foot the delay may be partly due to a more difficult co-ordination in the higher centres. The reaction-time is longer with the organs of speech than with the hand, but it is the same for the right and left hands.

Sec. 3. *Reactions on Touch.*—In the case of reaction experiments with dermal stimuli the electric shock has mostly been used, as it is easy to apply the shock to different parts of the body. We have, however, seen that the physiological effects of the shock vary greatly on different parts of the body, and even at the same point they cannot be kept constant. We have found that the same objective force of blow is followed by the same subjective sensation more nearly than in the case of electrical stimulation. On different parts of the body the same blow, indeed, calls forth different sensations, the sensations being more intense when the part is hard, as over a bone. But the difference is not so great as in the case of the electric shock, and at the same point the same sensation can be given time after time and day after day. The probable error is consequently smaller than in the case of the electric shock; indeed, the variable error in our experiments on touch is much smaller than in any reaction-time experiments hitherto published.

We used various methods for applying a touch or blow, but in this abstract we need only describe the method which we find best. We allowed a hammer to fall from a fixed height, the current controlling the chronoscope being closed when the blow was given. The weight of the hammer and the height from which it fell could be altered, as also the area with which the blow was given. A blow of a given force could consequently be given time after time, and the force and area of the blow could be varied when desired. We made reactions in answer to blows on different parts of

the body, the hammer weighing 30 g and falling 20 cm. The area which gave the blow was circular, 1 cm across.

The reaction-time with a blow was about 10σ shorter than with an electric shock. It was nearly the same for J and C, and about 30σ longer for D. Thus when the blow was given on the arm the reaction-time was (as the result of 600 experiments with each observer) 113.9σ for C and 114.7σ for J. When the blow was given on the thigh the time was 148.5σ for D and 121.5σ for C.

In some of the experiments we used three intensities of stimulus, the hammer weighing 15, 30, or 60 g and falling 20 cm. The blow from the 60 g weight was nearly painful on a hard part of the body, and the blow from 15 g was quite strong. There was not much difference in intensity of sensation and the decrease in reaction-time was not great. As a result of all the experiments (2400) the time was decreased 1.3σ when the weight was increased from 15 to 30 g, and was decreased 1.7σ when the weight was increased from 30 to 60 g. If, as Fechner's law assumes, the intensity of a sensation increase as the logarithm of the stimulus, the reaction-time would tend to vary inversely as the intensity of sensation.

The shortest reaction-time followed stimulation of the finger or cheek in the case of C (105.8σ for the finger and 103.1σ for the cheek). The reaction-time on stimulation of the finger was thus about 8σ shorter than on stimulation of the arm. As in the case of electrical stimulation we find that the cerebral reflex is shortened when the stimulus is applied to the opposite side of the body to a point corresponding to that with which the movement is made. The time was about 1σ shorter for the toe than for the thigh. As the average of two observers, the times for the neck and cheek were nearly the same.

The time was 7.8σ shorter when the stimulus was applied to the arm than when it was applied to the thigh. If this difference be due to the time of transmission from the lumbar to the brachial plexus, we should have a velocity of the nervous impulse in the sensory tracts of the spinal cord of about 40 m per sec. The times on the upper and lower

arm and on the upper and lower thigh, respectively, were the same. In the case of the arm the time for the upper point was 0.2σ shorter for J and 0.6σ longer for C. In the case of the thigh the time for the upper point was 1.1σ longer for D, and 0.1σ shorter for C. The difference in the length of nerve traversed is not counterbalanced by a difference in intensity. Doubling the stimulus shortens the reaction by only 1.5σ, and the differences in sensation were not so great on the different points as on the same point when the stimulus was doubled. When the stimulus is applied to a point further from the brain the time of transmission in the nerve seems to be exactly counterbalanced by a shorter cerebral time, the sensory fibres from a point nearer the extremities discharging more quickly into motor fibres to the extremities.

We do not think that the velocity in the plain nerve can at the present time be determined by differences in the reaction-time. But equal difficulties are present when the motor nerve is stimulated electrically. It would seem that the velocity of the impulse in the nerve can only be measured when we are able to record its progress, perhaps by electrical or chemical changes. But we hope our work has thrown some light on the subject, especially in the case of the motor and sensory tracts of the spinal cord. We think, further, that a general survey of our experiments indicates a rate in the plain nerve much greater than that commonly accepted of 30 m per sec.

We think that the study of the reaction-time is itself important both for physiology and psychology. These sciences cannot rank co-ordinate with the physical sciences until they consist of exact measurements. Experiments on the reaction-time have been of use in the analysis of physiological and mental processes and in studying the relations of these. The reaction-time has also certain practical applications in pedagogy and medicine. Thus experiments such as these indicate important personal differences, or they may be used to locate exactly the place of disease in the nervous system.

DISCUSSION.

COLOR-SENSATION THEORY.

I find myself much indebted to Dr. Sanford for his admirably lucid exposition of my color theory, but truthfulness compels me to confess that he attributes to me a degree of modesty to which I can lay no claim. The way in which I regard my own theory is perhaps rather difficult to seize: Dr. Sanford has quite misconceived the meaning of what I say concerning my attitude towards it. He says: "The author's theory, which is regarded, indeed, rather as an indication of the direction that such a theory should take than as a developed scheme, is," etc. Now I neither regard my theory as an indication of the *direction* that such a theory should take, nor as an undeveloped scheme. I do, on the contrary, regard it as (1) *a perfectly adequate* theory, that is, as a theory which actually does that which a theory of the phenomena in question is required to do; but, on account of the purely hypothetical character of the conception by which it accomplishes this (partial decomposition is one of the most familiar things in chemistry, but we do not *know* that it takes place in the retina), there is no reason to suppose that there may not be other conceptions possible which would fulfil the requirements equally well. In other words, I look upon it as a member of a *class* of theories, all satisfactory, and all, with our present knowledge, unprovable, but of a class which at this moment is composed of a single member only. The one great requirement of a color-sensation theory—and it is an immensely difficult one—is that it account for the absolutely unique fact in sensation that certain sensation-pairs (viz., any two complementary colors) lose themselves in a totally different sensation, and that other sensation-pairs, undistinguishable from these objectively, do nothing of the sort. Helmholtz explains this characteristic of color-vision by ignoring it. Hering gives a perfectly adequate explanation of it, but by means of a conception which has no parallel among physiological doctrines. My conception, I find myself obliged to think, is both physiologically unobjectionable, and capable of furnishing an easy explanation of the

critical facts of color-vision.* Of course, I am not saying that a good explanation of the most important fact of color-vision is *sufficient* for a theory, but only that it is *necessary*. The smallest fact discoverable, if it were incompatible with a theory, would suffice to overthrow it. Now any number of other members of this class of 'adequate' theories may spring up at any moment, but there is no reason to suppose that they would be at all similar to my theory, or at all in the same direction with it. It is much more likely that they would make use of totally different conceptions—derived from the phenomena of photo-electricity or of polarization of light, or even from something that would not be a *vera causa* at all, and not simply not a *vera causa in situ*.

Neither do I regard my theory (2) as an undeveloped scheme. It is true that the fictitious process in the retina to which I attribute the transformation of light into some sort of nervous excitation is an excessively simple one, but on the other hand it is quite sufficiently complicated for doing the work which is required of it; and any degree of complexity or development in a purely hypothetical scheme, beyond what is absolutely required in order that it may fulfil the function demanded of it, has no other effect than to render the theory needlessly cumbrous. The carrying out of the work of translating all the facts of color-vision into the terms of the theory will, I hope, follow in course of time,—unless, indeed, it should receive such hard blows as to lay it low before that time shall come.

But the sentence of my reviewer's to which I particularly take exception is this. He says: "As the author herself observes, if Hillebrand's demonstration of Hering's theories of complementary colors stands, it is fatal to her theory, at least in its present form." It would, indeed, be fatal to my theory, in any possible form, if Hillebrand's supposed proof that white-producing colors are antagonistic, and not complementary, were valid. (This is a very different thing, by the way, from a proof of Hering's theories; there may be many other antagonistic color theories, and there is one—that of Ebbinghaus.) Now it is open to my reviewer to say that it is matter of doubt whether Hillebrand's proof is valid or not, but to say that I say so is again to attribute to me a degree of modesty which I must hasten to disclaim. What I did say was, "*Were* Hillebrand's proof valid," etc., and I go on to say that I believe it to be thoroughly fallacious. My reviewer may consider that my objections to Hillebrand's argument do not hold, but to attribute to me the opinion that it is matter of even

* I am naturally very much gratified at finding that so acute a physiologist as Prof. Burdon-Sanderson has also expressed himself as of this opinion. *Nature*, vol. 48, p. 469.

doubt which way the truth may lie, on account of the slightly rhetorical way in which I have expressed myself, is hardly fair. To inflict upon the world a theory which was in my own opinion so near as that to being upset beforehand would be a highly reprehensible proceeding and one which I should not like to be guilty of.

I mention briefly (1) that I consider Dr. Sanford's objection to my explanation of simultaneous contrast to be well taken, and that I shall hereafter attribute that phenomenon to a purposeful reflex action, which is also Hering's explanation of it, at bottom; and (2) that the sensation of black is accounted for, upon my hypothesis, as the effect on the nerve-ends of the resting condition of the photo-chemical substance; it is therefore the antithesis to every color as well as to white, and it is the constant background against which all colors and white are seen. This is in harmony with the fact that, while Hering's *Lichthof* must play an important rôle among the phenomena of vision *there is no such thing as a Dunkelhof.* But this subject needs to be set forth at greater length. One other point I touch upon,—experiments upon the color wheel are inconclusive when their results are of a negative character, but only then. If a red-green gray and a blue-yellow gray, when made out of colored papers, act alike, it cannot be inferred that there is no difference between them, merely because the things sought to be compared not have been obtained with much purity; but if they act differently, it is another matter. A difference in the properties of two things can only be due to a difference in their constitution, and the fact that they are not as purely different as they might be does nothing to invalidate this conclusion. Moreover, the fact that two differently constituted grays vary unequally with changing illumination is, as I have mentioned, a deduction from König's exceedingly exact measurements of the Purkinje phenomenon. Hering attempts to account for it by a very rapid variation in the amount of coloring matter in the yellow spot under different illuminations. This would seem to be as inadequate to explain the large amount of difference which is observable as is his scheme for explaining the difference between the red-blind and the green-blind by differences in the amount of yellow substance in the retina of different individuals. That the phenomenon should cease to be detected at some little distance from the fovea is not strange in view of the very rapid falling off of the color sense on leaving the fovea, as exhibited in the curves laid down by Eugen Fick (*Pflüger's Archiv*, Bd. XLIV).

CHRISTINE LADD FRANKLIN.

BALTIMORE.

HERR LASSWITZ ON ENERGY AND EPISTEMOLOGY.

Herr Lasswitz draws two conclusions in his epistemological study of the modern theory of energy (see notice of articles under Psychological Literature) which have a psychological value. The first is that the substitution of energy for mass in formulating the equations between the so-called 'forces of nature' obviates the fallacy which follows a too common interpretation of physics, that its fundamental unit is expressed in terms of the sensation of touch. A molecule or atom is of course as far beyond the possibility of a sensation of touch as it is beyond one of sight. Nor are we justified in carrying beyond the limits of perception, by magnifying in imagination, those sensations which have followed the exact determinations of the phenomena of nature down to this threshold; for these very determinations demonstrate that below this point the balancing of energies between spatial objects, among which is the human organism, does not allow of a reading into terms of any sensation.

We are forced by this into the conclusion that physics in so far as it involves determinations which run out to the indefinitely small must always abstract from the quality of the sensation, and leave simply the *rational* statement, in terms of magnitude, of the dependence of the processes of nature upon each other.

We wish to draw one important corollary from this proposition. The impossibility of dividing the sensation up into equal parts—of dividing one sensation up into the several sensations which should compose it—has been already maintained with sufficient emphasis in criticism of Fechner's Psycho-physical Law, but the essential difference which lies between the methods of the natural sciences and those of psychology expressed in the threshold values of the various sensations (that is, the absolute beginnings of sensations contrasted with the possibility of reducing the stimulus to an indefinitely small magnitude) has not been sufficiently insisted upon.

The difference is perhaps most succinctly brought out by the contrast between the quality in sensuous experience and the same in physics. The first is static in its value—that out of which a naïve dualism constructs matter. The second is but the law in the midst of change. It is only by the infinitesimal concept that the physicist is able to express color, sound, resistance (touch), etc. The problem of the physicist is to make a magnitude out of change—by means of the mathematical formula. He has, in expressing color, only a periodicity

in a process of radiation upon which to base the static element that makes up the content of most objects of perception.

The problem of the experimental psychologist is just the opposite. It is to find a change that may be expressed in law, in a magnitude which cannot be broken up. Sensation, emotion, feeling are magnitudes which within themselves suffer no disintegration, can be broken up into no parts. The psycho-physicist has hit therefore upon the ingenious expedient of paralleling the infinitesimal state in the physical phenomena by the just observable differences in the psychical. The results of this method of research have, however, but poorly rewarded the remarkable ingenuity expended upon it. And a moment's thought will reveal the inefficiency of this tool borrowed from the physical sciences.

The validity of the infinitesimal statement lies in its definition in terms of the law. The process is but arrested to assert the relations which lie between its different moments. How different the just observable difference in psycho-physics! Here there is no law in which to define the state, but we are confronted by a series of equations in which $a = b$, and $b = c$, but in which $a \lesseqgtr c$.* Instead of defining the arrested process in terms of its formula, psycho-physics has striven to formulate a law out of a series of states that can be defined no more nearly than in the assertion that they are different. How futile would be the attempt to build up the law of the circle out of successive relations of the co-ordinates, these not being defined in terms of the angles made with a vanishing secant, but only in the assertion that the successive co-ordinates are just perceptibly different from each other! Measure these co-ordinates as exactly as one may, and he has still no content in the successive states and can reach such a content only when he can define the relations of the co-ordinates absolutely by means of the law of the curve.

In a word, the physicist has abstracted the entire mathematically statable content of the sensation—and only this; and for the psycho-physicist to strive to use that which is left for the same purpose is to make it evident that he does not comprehend the relations of the two fields. We trust with Herr Lasswitz that the substitution of energy for mass in the physicist's statement will carry home the nature of the scientist's abstraction.

The unity which underlies the physical object or system (*Gebilde*) is thus reduced to a rational categorization which is the framework of consciousness—a framework which is given and of which the unity of the individual consciousness is but an expression. This is the sec-

* Natorp's *Einleitung in die Psychologie*, p. 84.

ond of Herr Lasswitz's propositions, and he draws from it the solution of the problem of the relation of the unity of the object to the unity of the individual consciousness. It is really only a deduction from the first proposition. Granted that the unity of the full sensuous object is that of the individual consciousness, the categorization in terms of space, time, and energy abstracted from this must fall under the same unity.

An important corollary to this, which also fills out the criticism passed upon the method of psycho-physics, is to be found in the continuity of the methods of exact science even if carried up to the full psychical phenomenon.

Professor Baldwin has identified Kant's transcendental unity of consciousness with attention. If we now define attention as the domination of any one act over all tendencies to action within the organism at any one time, and define the object as a group of activities co-ordinated with reference to some particular act,* we have a psycho-physical fact which can be stated in terms of the food-process by the biologist and of the compensation of the intensities of energy by the physicist. For an object which is a co-ordinated group of activities must have developed in the process of evolution under the same law which governed the development of the whole organism. This can be stated in terms of a food-process—involving the assimilating of food, its expenditure in motion which brings the organism in contact with new food, a negative reaction upon a non-nutritious or dangerous environment, and an overflow in reproduction. The same process must serve as a formula for the development of the psychological object, constructed as it is out of the activities which the search for food in an increasingly complicated environment has called out.

But the more abstract laws of physics are no less applicable than those of evolution to objects so constructed. A single instance may be found in the parallel set of relations of the various energies of light, sound, etc., to that of mass; of the sense-organs of color, tone, etc., to that of touch; of the sensations of color, sound, etc., to those of contact.

These may be read into a relation between an energy acting continuously along a single line and periodical energies of radiation acting along innumerable lines. Whether these latter may be expressed in terms of vibrations of particles of a ponderable medium and so be reduced to mass or not, the ideal of physics will hardly be reached

* Professor James has shown that our object changes completely with the activity which it represents, that a paper which presents a surface for the pen is quite a different object from paper used for kindling a fire.

before they are reduced to some single form of energy. We shall have something strictly analogous to the relation between direct action and action through media. The assumption that all senses may be reduced to that of touch or contact has long been practically unquestioned. And here we have the relation between sense-organs that receive direct continuous contact and those that respond to radiating periodical stimuli, serving as before to express immediate relation and that through media: or, in other words, the relation between physiological reactions upon direct contacts and those upon medial contacts which serve to make the direct contacts possible. Lastly we have the sensations of color and sound which have a character symbolical with reference to touch, and the activities which they call forth mediating the more important activities which are called forth by the stimuli of contact.

If, now, the psychological object be formed out of full sensuous activities responding to stimuli which affect the different sense-organs; if these reactions take place in a system built up by action upon its environment, and if the relations of its environment to it are expressed in the fundamental laws of energy, evidently those reactions and those objects must be functions of the laws of physics. A statement of the object in terms of our activities enables us to apply the laws of the exact sciences to their development and relative values.

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PSYCHOLOGICAL LITERATURE.

GENERAL.

A Theory of Development and Heredity. HENRY B. ORR, Professor at the Tulane University of Louisiana. Macmillan & Co., New York and London, 1893. Pp. ix + 255.

This very interesting and suggestive little volume by Professor Orr follows Professor Brooks' 'The Law of Heredity' of 1883, as the second work upon this subject which has appeared in this country. Professor Brooks' theory was an expansion and modification of Darwin's provisional hypothesis of Pangenesis, and was truly a theory both of Development and of Heredity. Professor Orr's work is an original modification of the speculations of Lamarck, Spencer, Butler, Haeckel, and others, and is a theory of Development based upon the psychic properties of living matter. The reviewer is unable to see wherein the author has advanced a theory of Heredity proper.

Lamarck ignored embryology in his work of 1802, but it is clear that a modern theory of Heredity must take into account the facts of embryology, and recognize that new individuals arise, not from all parts of the body, but from extremely circumscribed germinal cells. These cells are set apart at the outset of the life of the individual, and become, so far as we can see, among the most *isolated* in the body; yet they contain the whole store of Heredity. It is further clear that a Lamarckian theory of Heredity must connect the activities of the body in some way with the activities of these cells. Otherwise these activities can in no way be impressed upon the second generation. Professor Orr passes over this supremely difficult point in the transmission of somatogenic or acquired characters as if it were of no consequence, but it is one which Lamarckians cannot evade. From the fundamental principle of elementary nervousness running through this book, the reviewer expected that the author would seek to connect his psychic development of the individual with the hereditary germinal substance through the nervous system, as this system is essentially the material vehicle of the psychic side of organic matter, but he does not do so. The investigations of Golgi, Cajal, and Retzius have revealed a nerve-supply of all parts of the body vastly greater in extent than we ever

supposed. Every tissue is permeated with an infinite network of the finest nerve-fibrils. Retzius has especially investigated the nerve-endings in the region of the germinal cells, but thus far his preparations show that these cells have rather an under than an over supply of nerve-fibrillæ. The sympathetic connections of various parts of the body through the nervous system are so remarkable that we can conceive that this system may be the medium of connecting the changes in the body with the potential activities of the germinal cells. Yet, at present, we must admit that in all the activities of the body there is nothing analogous to that which would be requisite for a nervous theory of Heredity, namely, that certain specific changes in certain parts of the body should affect the hereditary germinal substance in such a manner as to cause similar changes to appear in the offspring.

The strength of this work lies, therefore, upon the side of individual development; and, as it is a psychic theory, it appears to be especially timely in connection with the present monistic development of biological thought as expressed by such writers as Lloyd Morgan, Romanes, and Haeckel. The gist of the argument is that, starting with elementary nervousness as one of the fundamental properties, the effects of the reactions of living matter to environment are analogous to those seen under the laws of repetition and association in mental phenomena; that stability of function and structure bears a direct ratio to the frequency of reaction, and that all functions are built up in association with others. The volume opens with a general statement of the problems of evolution raised by Weismann, and throughout there are scattered some very forcible arguments against the theory of evolution exclusively by the survival of fortuitous favorable variations. The standpoint of the author is with Lamarck and Spencer, that the reactions of the individual to environment is by transmission, the main factor of evolution. Nervous conductivity in animals, and some similar power in plants, connects the organism with its environment. We follow the author step by step in his long and very ingenious argument based upon the analogy between mental processes and the slow steps by which living matter gradually acquires its more and more complex characters. As the mind gains ease, frequency and fixation of certain processes by frequent repetition, so in development characters become stable according to the period of time in which they have been performed. Thus the strong 'hereditary impulse' is built up. The application of this analogy to the simple life-processes of the single-celled organisms, of the two-layered organisms such as Hydra, and of the highly compound organisms, is carried out with a great deal of force in the sixth and seventh chapters. On the mechanical side of development and the

origin of variations Professor Orr gives a rather naïve treatment of the kinetogenesis theory as applied to the skeleton (page 158), not referring in any way to the researches of Hyatt, Ryder, Cope, Arbuthnot, Lane, and others, which have covered this subject in such detail, the evolution of the complex surfaces of joints and relations of these surfaces to certain muscles and tendons being one of the favorite subjects with the Neo-Lamarckians. He refers degeneration wholly to the inherited effects of non-reaction, and points out in the overfed parasitic animals, where the economy of growth principle cannot operate, that degeneration is quite as rapid as in the struggling cave-forms of life. The phenomena of correlation of growth, of dimorphism and polymorphism in species, of alternation of generations, of the origin and significance of sex, are all treated in a thoroughly interesting manner.

The question remains, in conclusion, whether or not this contribution of Professor Orr's advances the great biological question of the day; whether the application of the laws of psychology to all the phenomena of life is 'a real advance in the right direction. as the author modestly expresses it in his preface. Is this application merely based upon analogies or upon a real similarity? This is the critical point. Real similarity necessitates one of two conclusions: either that all the activities of the organism—contractile, secretory, metabolic, reproductive, and mechanical—have two sides, the material side and the psychic side, and it is only in the irritable and automatic activities that the material side is subordinate and the psychic side predominates; or, second, that the elementary nervousness, expressed in the nervous systems of higher forms, is the dominating factor in evolution. This second conclusion lands us in the difficulty which we have seen at the outset—that if the author's theory of evolution is the correct one, the relation between the nervous system and the hereditary germinal substance should be very conspicuous, whereas we find at present that it appears to be rather obscure. The prior conclusion forces us to assume that besides the nervous system the psychic side of the activities of life are carried on by some mechanism or unifying principle in organisms at present unknown to us. If there should in future prove to be such an unknown unifying principle, Professor Orr will have made a substantial advance in the right direction. HENRY F. OSBORN.

COLUMBIA COLLEGE.

Elements of Psychology. By JAMES MARK BALDWIN. New York, Henry Holt & Co., 1893. 12mo. pp. xvi + 372.

The aim of the author of this manual is to present the newest essentials of the science in a single compact volume. The book is a con-

densation of his well-known *Handbook of Psychology* (2 vols., 8vo, same publishers). He has aimed to simplify the exposition throughout by omissions, by recasting whole chapters, and by adding illustrative facts and explanations.

The Introduction (pp. 1–55) consists of four chapters. The first requisite of a science is the recognition of a distinct group of facts or phenomena to be explained. The writer very wisely, therefore, begins (ch. 1) by drawing attention to the differences between psychological and physiological phenomena. The second requisite of a science is the application of the methods of science to the facts to be explained. The method of psychology is next (ch. 2) presented. Then follows (ch. 3) an account of the structure and functions of the nervous system. The treatment of this subject has been put here at the beginning as a pedagogical concession to the critics of the *Handbook*, in which it appears as the introduction to part third. It is rather hazardous to attempt to present the salient facts of nervous physiology, and that too to beginners, in thirty pages; and the author is to be congratulated on the successful way in which he has done it. He closes the Introduction by (ch. 4) dividing his subject into four parts: the General Characteristics of Mind; Intellect; Feeling; Will.

Part First (pp. 56–80) discusses Consciousness and Attention. He distinguishes between Consciousness and Self-Consciousness. The former is the common and necessary form of all mental states,—their one condition and abiding characteristic. The nervous conditions of consciousness and the development of consciousness are briefly discussed. Then follows (ch. 5) a presentation of the nature, forms, and bearings on the mental life, of Attention.

Part Second, on Intellect (pp. 81–221), consists of nine chapters: Division of the Intellectual Functions; Sensation; Perception; Retention and Reproduction; Recognition and Localization; Association; Imagination; Illusions; Thought. The intellectual function is divided into the *Apperceptive* (embracing presentation, representation, and elaboration) and the *Rational*. Strange to say, 140 pages are devoted to the former, while nothing but a bare allusion (p. 221) is found in the book about the latter. The treatment of the Rational Function in the *Handbook* was meagre and unsatisfactory, but to pass it over in almost absolute silence in the *Elements* is a serious defect in the book. The presentative function is next divided into *Sense-Perception* and *Self-Consciousness* and then less than a single page (p. 126) is given to the latter all-important subject. In these particulars the simplification by condensation is decidedly no improvement. The next chapters on Sensation and Perception are among the clearest and best in the book. Sensa-

tions are "both affective and presentative," although "the intensive subjective state constitutes the sensation proper." They have as general characteristics which may be investigated, *quality*, *quantity*, *duration*, and *tone*. Sensations differ qualitatively independently of their hedonic tone. He finds it "reasonably safe to conclude that there are well-specialized nervous functions which correspond to the great differences of quality in sensations." The various classes of sensations are presented, and muscular sensations and the phenomena of contrast are discussed at considerable length. Under quantity of sensation, Weber's law is stated and the results of the psycho-physical inquiries to which it has led are indicated. Incidentally *extensity* is distinguished from quantity viewed as intensive and the remark is made: "The fact that it is found in connection with some of the non-spatial senses, e.g. sound, seems to be sufficient proof that it is not an immediate datum of space-knowledge, as some would have it." The time-relations of sensation (Psychometry) are then summarized, and the subject of their *tone* postponed for later discussion. The chapter on Perception is brief for so intricate a subject, but it is marked by great simplicity of treatment and clearness of statement, whatever may be thought of the positions taken. The problem is to explain our adult consciousness of a world of clearly discriminated, tri-dimensionally extended, extra-mental objects located in the midst of surrounding extents of which the world consists. He finds three logically (though not chronologically) distinct stages or steps in the development of this consciousness. The first is *Differentiation*. "It is probable that the earliest consciousness is a mass of touch and muscular sensations experienced in part before birth, and that it is only as the special senses become adapted to their living environment and sensitive to their peculiar forms of excitation that the general organic condition is broken up and the kind of sensations differentiated" (p. 60). The second stage is *Localization*—the mental reference of sensations to a locality in space: the passing from a subjective consciousness to an objective. This is effected in connection with our muscular and touch sensations. The third and final stage is *Sense-Intuition*, in which the mind by attention and association identifies things seen with things touched, etc., that is, gathers together the sensations into the permanent units or wholes which we call 'things. Throughout the discussion the activity of mind, and the fact that perception is an achievement of the mind, are emphasized.

The next two chapters treat of Reproduction—memory as retentive, reproductive, and recognitive, together with consciousness of time. A satisfactory discussion of the representative 'image' and its functions in the mental life is lacking here; otherwise the subjects are sugges-

tively handled, especially the subject of time. Under the head of 'Combination' follow two chapters, one on Association and one on Memory. The position is taken that *contiguity* is the one ultimate law of association. The control of association by the rational will and its relation to the higher thought-activities is scarcely referred to, and no reference is made to the important principle which Professor Ladd so happily describes as 'condensation' in association. On the whole the discussion of association leaves much to be desired even in so elementary a treatise. A helpful chapter on Illusions follows the discussion of memory.

The treatment of the Intellectual Function closes with sixteen pages devoted to Elaboration or Thought—conception, judgment, and reasoning. The treatment of these important subjects is so brief as to be almost worthless. The author would have done better if he had not attempted to treat these topics in detail. As it is, his treatment is not so very serious a defect, as at this point the book would probably be supplemented, by those using it as a text-book, by some elementary work on logic.

Part Third, on Feeling (pp. 222–307), consists of seven chapters: Nature and Divisions of Sensibility; Pleasure and Pain; Nature and Divisions of Ideal Feeling; Common Ideal Feelings—Interest, Reality, Belief; Special Ideal Feelings—Presentative Emotions; Special Ideal Feelings—Emotions of Relation; Quantity and Duration of Emotion. For this part we have almost only words of praise. The second volume of the author's *Handbook*, which treated of the Feelings and the Will, was a distinct improvement on the first volume, which treated of the Intellect. And this condensation is a decided improvement on the *Handbook* in two particulars: sensuous pleasure and pain and ideal pleasure and pain are treated together in one chapter and not separated as in the larger work; and much of the indefiniteness which characterized the larger work disappears in the smaller. After discussing (ch. 16) the nature and divisions of sensibility, he divides all feeling into *Sensations* and *Emotions*. All Feeling in addition to its qualitative and quantitative characteristics has *tone* (pleasure-pain). Having in the first part discussed Sensations, he confines himself in part third to Pleasure-Pain and the Emotions. The discussion (ch. 17) of the physical conditions and the nature of pleasure and pain is excellent. A suggestive chapter (19) follows on (Common Ideal Feeling) interest, reality, and belief. The next two chapters (20, 21) treat ably, following in the main the Herbartian classification, the various kinds of Emotion. The treatment of 'Conscience,' however, is unsatisfactory; and all that is said of the religious emotion is: "The great class of

religious feelings are also most closely connected with ethical emotion and rest upon it." This part closes with a chapter on quantity and duration of emotion, in which a variety of topics such as emotional expression, the association and conflict of emotion, and the like are handled.

Part Fourth (pp. 308–372) consists of chapters on the Motor Consciousness, Stimuli to Involuntary Movement, Stimuli to Voluntary Movement, Voluntary Movement, Volition. Exception will be taken to much that is said or implied here, according as one agrees or disagrees with the author's general philosophical position. The facts, however, are carefully and impartially presented; and the discussion as regards both matter and form is superior to what is usually found in elementary works. This third part does much to give completeness to the work.

We have reviewed this book at such length for the reason that in spite of all the defects to which we have alluded, and others which we have passed over, we regard it as, on the whole, the best elementary text-book on psychology for use in academies, high-schools, and our smaller colleges now before the public. It is written from the scientific standpoint and in a thoroughly scientific spirit by one versed in the literature and acquainted with the latest advances of the science. The only other book which can compete with it is Professor James' *Briefer Psychology*. It lacks the brilliant qualities of James' book, while, on the other hand, it is more systematic and complete and hence better adapted for a text-book. The two books admirably supplement each other. If the one could be used as a required text-book and the other as supplementary reading, we believe that elementary instruction in psychology would be vastly improved. The mechanical make-up of the book is excellent; but the publishers should see to it that an index is added.

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CHILD-PSYCHOLOGY.

L'Evolution intellectuelle et morale de l'enfant. G. COMPAYRÉ. Paris, Hachette, 1893. Pp. xxiv + 371.

The Psychology of Childhood. FRED. TRACY. Boston, Heath & Co., 1893. Pp. 94.

In the present condition of the study of the psychology of childhood, books of two classes are necessary aside from the detailed records of exact observations and experiments. We need first of all summaries which shall offer us from time to time exact and minutely-detailed topical statements of all observations already made by everybody and

everywhere. Such statements are necessary, if reliable and exhaustive, to all who are themselves making observations or using them for purposes of interpretation. The second class of works which are needed, and which alone truly represent the object of the study, are works of interpretation and theory whereby the net results of the observations of all workers are made available for general psychological theory, especially on its genetic side.

The work of Compayré is not adapted to either of these purposes, nor does the author himself make new observations of importance on children. His book—magnificently printed on very heavy paper with wide margins—follows the French traditions on this topic. He covers the whole field in a pleasant, too-talkative style, stating old hypotheses clearly and well, without too much criticism, and failing to bring—as Perez fails to bring—the observations cited into range of the more important genetic questions ot later discussion by psychologists. Apart from interesting *aperçus* on minor points—such as the dependence of the child's memory on present objects (127 and 139), the recognition of 'automatic' imitation (181), etc., I find no important gain either to theory or fact. The book, however, will do good service as an 'Introduction' to the subject for readers who want to know the general state of the questions at issue and the nature of earlier observations and literature. It is probably the best book of this character; and possibly this is what the author had mainly in mind.

Tracy's work falls distinctly under the first of the two useful categories I have mentioned—a remark which I have a right to make, since it was undertaken at my suggestion and much of it written in consultation with myself with the purpose explained above in view.* As far as the carrying out of this purpose—to produce a condensed objective statement, by topics, of all work done to date everywhere—as far as this is concerned, the work is to be heartily commended. Tracy covers the literature much better than Compayré (who, for example, makes no reference, I think, to American work). He is also less subjective, although in this respect some of his sections might be further improved. The chapter on 'Language,' moreover, makes contribution to the theory of infant speech—a point which was spoken of by Prof. Dewey in the last issue of this REVIEW (I. p. 63 f.). I have, therefore, no hesitation in endorsing the words used by President Hall in his preface: "This work was greatly needed, and has been done with a thoroughness which all interested in the subject must gratefully recognize." The real value of the book, however, for its purpose, is almost entirely negatived by its external blemishes and deficiencies. It has neither table of contents

* See the author's note, B, p. 90.

nor index: a most remarkable double oversight in a book whose *raison d'être* is ready reference. Suppose a reader desirous of knowing all the observations hitherto made on the infant's 'walking reflex': he has not only no way to find this topic, but, further, no way to find the chapter in which it occurs—except as he may turn pages until he find the chapter on 'Volition,' and then look through that until he find a section which would 'seem likely' (such a section as 'reflex movement') —and explore that until, not finding what he wants (as he would not find this particular topic; it is probably an omission, though it may be where I have not looked), he would have spent and lost his time. It would seem necessary, if the book is to do what its excellences really fit it to do, that a detailed index should be prepared and sold with the work. It could then be bound in by the purchaser. Further blemishes, also, increase one's sense of the extreme carelessness of some responsible party. The print of the text is ruinous to the eyes in any light but daylight, and the foot-notes would arouse the *laboris amor* of histologists. Further, there are three typographical errors on the first three-quarter page of Chapter I, and the proportion seems to be pretty well kept up throughout. Nothing but a new edition would correct these blemishes: and it is to be hoped, in view both of the late results which should be frequently incorporated, and of the merit of the author's labor, that a new edition may soon appear. In that case it is to be hoped that Dr. Tracy will not again allow his work to be so mangled. J. M. B.

THE NERVOUS SYSTEM.

Die trophischen Eigenschaften der Nerven. J. GAULE. Berliner Klin. Wochensch. Nos. 44 and 45. 1893.

Die trophischen Eigenschaften der Nerven. J. GAULE. Auszug aus dem in Nürnberg auf der Naturforscherversammlung gehaltenen Vortrage. Centralb. f. Nervenh. und Psych., Nov. 1893.

The background of organic processes of which our special sensations form the visible surface is of recognized psychological importance. From the physiological side this background may be considered as the total result of those activities of the nervous system which are called trophic, and hence an interest attaches for us to any advances in this field.

The titles given above refer to a running account of the general conclusion at which Gaule has arrived after experimenting for several years. He establishes his theoretical standpoint by dividing the forces acting upon the living organism into two groups: the group which we

commonly recognize, which directly affects the sense-organs and thus calls forth those responses in the muscles and glands whereby adaptation is accomplished. But besides this group of which we are conscious there are such forces as gravity, humidity, atmospheric pressure, electrical tension, etc., which are constantly present, which change slowly, but of which we have as a rule no direct consciousness. Nevertheless we must also adapt ourselves to this latter group, and the processes by which this is accomplished may be designated as the trophic functions of the nervous system.

Experimenting, he repeated in the first place Majendie's operation on the fifth nerve, in which that nerve is cut intracranially. We know that at whatever point in its course this nerve is cut the cornea becomes anæsthetic. If the section be made in such a way as to damage the nerve-cells of the great Gasserian ganglion or the smaller number of cells found in the course of the nerve where it joins the medulla, then besides the anæsthesia, there appear trophic disturbances.

In this latter instance trophic changes are said to occur in the cornea in spite of all possible protection offered to it, whereas in the former, in which the cornea is merely anæsthetic, mechanical protection from outside influences is sufficient to prevent any trophic change.

Gaule insists that we are, therefore, to consider the trophic disturbances as due to the group of the general forces which he has enumerated and against which it is not possible to offer any protection. Since, however, the forces which were involved act in the same manner on both the eyes and only one of these shows change under the influence of them, we should look for the cause of these changes in the injury to the organism itself. From these experiments, then, we conclude that the connection of the cornea with injured ganglion-cells belonging to the fifth nerve disturbs its normal nutrition, and that this disturbance must depend upon some influence emanating from the cells themselves. The disturbance, then, has its origin in the nerve-cells, and whether we consider it as due to excessive or reduced activity there makes comparatively little difference. Furthermore, it is to be noted that this influence is transferred from the ganglion along the nerve to the periphery, a direction which is the reverse of that in which we ordinarily picture this nerve as acting.

Gaule next investigated the spinal ganglia in frogs and rabbits, and found as a result of excitation trophic changes in the muscles, glands, and skin. Taking the rabbits, which give the clearest reaction, the following results were obtained: these ganglia can be excited so as to bring about trophic reactions by the interruption of rather a strong, constant current, by cutting in various ways, and by cauterizing. In-

duction currents were found ineffective, and the stimuli mentioned produced results only when acting upon the ganglion still inclosed in its sack. If the sack had been previously opened no results followed. The distribution of the disturbances was not only in the area supplied by the sensory nerve, the ganglion of which was irritated, but it extended outside that area. So far as the muscles were concerned the trophic changes not only affected those of the same side and those most closely associated with the sensory nerve concerned, but also others which were remote. At the same time they affected muscles in the opposite half of the body. It will be seen from this that the trophic influence of the spinal ganglion is not only exerted in the same manner as in the case of the Gasserian ganglion, but that also it must act through the spinal cord in order to produce the disturbances in the muscles. That such is really the pathway for the impulses is indicated by the fact that section of the dorsal root between the ganglion and the cord abolishes the effect upon the muscles. Both the conditions of effective stimulation and the distribution of the effects, as thus described, are well calculated to excite remark, not to mention the fact that the disturbance can be passed on from the sensory to the motor fibres.

When Gaule turned next to the study of the sympathetic ganglion, and confined his attention to the changes taking place in the muscles, he was able to control the results with more accuracy. He used the inferior cervical ganglion which was connected by the ramus communicans with the spinal ganglion. Upon injury or stimulation of this ganglion there appeared constant changes always occurring in the same muscles (biceps brachii and psoas) both upon the same side as that of the ganglion which was stimulated and also upon the opposite side. The fact that this influence thus crossed the middle line showed that the action must take place by way of the spinal cord, and Gaule conceives that the pathway is along the ramus communicans to the spinal ganglion and thence to the cord. There is one curious condition, however, which is said to control these results. One of the branches of the inferior cervical ganglion acts to inhibit its trophic function in such a way that if, when the ganglion is stimulated, this branch is also stimulated, the results recorded do not follow. The trophic change which occurs in the muscles as the result of stimulating the sympathetic ganglion brings about a solution of the muscle substance somewhere about the middle of the muscle, the fibres rupture, blood-vessels are broken, and an ulcer is formed, which on the cessation of the stimulus slowly disappears with the formation of scar tissue.

The most striking fact which Gaule has to communicate is that this process can be followed from its very beginning in the living

muscle of the animal undergoing stimulation, and the various changes leading up to the formation of the ulcer can be directly observed. Such being the case, we have through these investigations some very important and wide-reaching phenomena forced upon our attention, and the fact that by stimulation of the sympathetic ganglion we can regularly develop ulcers in a given muscle must command attention, however peculiar and inexplicable some of the minor points may appear. H. H. D.

ABNORMAL.

Les altérations de la personalité. ALFRED BINET. Internat. Scientific Ser. Paris, Alcan, 1892. Pp. viii + 323.

The use and development of the experimental method in psychology are giving an entirely different aspect to most of the questions to which this science gives rise, and are beginning to profoundly modify our views as to some subjects which had remained, almost to our own day, the objects merely of abstract analysis. In the mind of the metaphysician the idea of personality calls up the conceptions of individuality and self-identity. Every one who experiments is continually seeing how often the facts contradict theories based solely on logical deductions.

In this work M. Binet makes a study of the problem of personality. He publishes a very considerable number of observations, some of them made by himself, and some taken from the works of leading writers on this important subject. But, as he states in the introduction, he makes it an invariable rule to rely only on such observations as can be easily verified. His inductions have been drawn only from facts over which those making the experiments have had control, which have been reached by different methods, and in the majority of cases from different points of view. Double alterations of the personality of the same individual, the alternation or the coexistence, the separation or the conjunction of distinct consciousnesses, are the phenomena which he analyzes successively, in both natural and artificial sleep, in hysterical anæsthesia, in the conditions of diverted attention and of suggestion. Even normal subjects may present a plurality of consciousnesses. In the light of these phenomena the theories of the association of ideas and of memory are enriched. Sensation, judgment, and reasoning may manifest their presence subconsciously apart from the normal personality. The book, although limited to the question of personality, throws light on the whole field of psychology.

Binet first studies the spontaneous phenomena. "They present," he says, "this great advantage, that the preconceived idea of the nar-

rator does not involuntarily or unconsciously distort them." The observations, some of which have become classic, of Azam on Felida, of Bouru and Burot on Louis V——, of Mesnet on F—— the sergeant of Bazeilles, of Guinon on B—— the journalist, etc., show that the same individual may have successively two or more mental conditions in which it is possible to discern two important psychological modifications, a change of character and a modification of memory. When the experiments come to be more methodically conducted, moreover, a third element comes to light, viz., the distribution of sensibility on the surface of the body.

Two classes can be named: sometimes the person affected (like Felida and Louis V——) continues while experiencing the second condition to live his ordinary life, keeping his mind open to all the usual perceptions and ideas: sometimes (like F—— and B——) he is delirious—he is possessed by thoughts which give to his activity a systematic trend, and he avoids everything not germane to his immediate prepossession. Nor does it infrequently happen in either the one case or the other that the individual affected manifests more than two, sometimes even five or six, different mental conditions.

The changes in character are very marked. Subjects pass from melancholy to gayety, from sober and honest persons to gourmands and thieves. Their sensibility is altered. F—— preserved in the second condition his muscular sensibility; but he lost his general sensibility, hearing, taste, and smell. His sight was not exercised except on the occasion of touch, and was restricted to those objects with which he was in actual contact.

The modifications of memory are also very interesting. In the normal state, the subject does not remember what happened during the second state. In the latter, when he is not delirious, he sometimes forgets the events of the normal state; but more often he remembers them. He remembers, equally well, everything he did and said during his former experience of the second state. His memory may also extend very far into the past and embrace periods which had been entirely forgotten in the normal state, but which he will now recall in most minute detail. When he is delirious in his second personality—what is his condition? In the absence of direct testimony (since we cannot speak with the subject) the repetition or continuation of actions begun in the former second state sufficiently demonstrates the unity of the somnambulistic personality. B——, the journalist, continues while in successive second states to write a novel and takes up the story each time at the right point, at the very word where he had been interrupted.

Certain observers (and among them Menet, who has studied the case of F——) believe that in the abnormal state there is no trace of conscious thought, of judgment, or of imagination. Huxley, indeed, has used this as evidence in support of the epiphenomenon-theory of consciousness. They believe that actions of subjects are the effect of a purely reflex and mechanical activity. Binet believes this opinion to be erroneous. For in the course of the experiments, patients give evident signs of surprise or astonishment at sounds, which would not happen if consciousness were absent.

During the normal state, what becomes of that extraordinary existence which possesses its own memory and its own character? Direct observation can give no answer. The experiments of Gurney show that traces of somnambulistic experience may continue in the waking state without the normal patient having the least suspicion of it. Numbers and names have been repeated to the somnambulistic subject. On awakening he remembers nothing. A rolling planchette with a pencil attachment is placed in his hand. In a few minutes his hand moves and writes the exact words and numbers which had been pronounced. There are thus coexistences of two distinct consciousnesses, "an *ensemble* of distinct psychological phenomena, thoroughly co-ordinated the one with the other, kept apart and continued without reference to normal personality." The somnambulistic personality is also a unity, since when the subject is again put to sleep, he declares that he has been writing with the planchette.

The second part of Binet's book is devoted to these phenomena of the coexistence of more than one consciousness. They are most easily observed in hysterical insensibility and in the state of diverted attention. Hysteric anæsthesia is an insensibility by reason of the partial unconsciousness which proceeds from the fact that the personality of the subject is cut in two or doubled. From an anæsthetic arm we may obtain the phenomena of the repetition of actions and of adaptation. When a pencil is placed in the anæsthetic hand of the subject and is concealed from him by a hand-screen, the hand itself will repeat a great many times a sign or letter which the subject is told to write. The subject, however, has consciousness neither of the impulse given to his fingers nor of their natural movements. Shall we say, then, that this is the effect of a mere physiological mechanism? This is doubtful, for the hand does not give evidence of memory alone. If, with a blunt point, we trace on the hand letters or figures (impressions which the normal subject does not feel at all) this will be enough to make the hand write them. There has been, then, a transformation of cutaneous sensations into their graphic equivalents. It is better still if one

voluntarily alters the spelling of a word. In this case, the hand hesitates and restores the correct orthography. It cannot, then, be said to be a passive condition. Furthermore, when the hand is guided, it is often observed to resist or anticipate the movements of the operator. When the subject is writing with his anæsthetic hand, it often happens that the hand repeats the same letter over and over, a sort of hand-stammering in fact.

Have motor images been partially awakened subconsciously so that as long as they meet with no resistance they expend their force in repetition of the act? It may with equal reason be supposed that there is something in these actions in the nature of a suggestion comprehended by a subconscious subject.

We now pass to the phenomena of adaptation. Suppose that we excite the anæsthetic arm of a subject, concealing it by a screen. If the arm is supported for a moment it remains stretched out. If we wish it to fall we raise it and suddenly release it. The arm seems to understand the wish of the operator. If a weight is suddenly attached to the subject's arm, an effort is made proportioned to the new burden. If, on the contrary, we support the arm, it will be gradually lowered. If a well-known object is placed in the insensible hand, touch will suggest its use. It will open and shut a pair of scissors or press a dynamometer. Some subjects cannot be influenced except by their regular hypnotizers. Neither can an anæsthetic arm be placed in a state of catalepsy except by one operator. If any other hand touch the subject the phenomenon does not occur. The unconscious subject can therefore exhibit choice. Now there are some phenomena more complex than these. If the anæsthetic hand of a subject be pricked from behind a screen, he exclaims, 'You have hurt me!' Should we therefore say that sensibility was restored? We question him, and he replies that he has felt nothing and has said nothing. It was the unconscious that for a moment appeared upon the scene.

"To explain how unconscious actions are produced," says Binet (p. 117), "we must not be content with the hypothesis of unconscious sensations. Isolated, unconscious sensations could produce nothing. Now, in analyzing the principal observations which we have collected, we have noticed the intervention of phenomena of memory and of reasoning, so that the unconscious movements reveal within us the existence of an intelligence other than that of the self of the subject, and which acts without his aid and even without his knowledge.

Binet next studies the phenomena obtained by aid of diverted attention. Attention is an effort of the mind and of the organism which has the general effect of increasing the intensity of certain states

of consciousness. This does not happen without attention. All that is not the object of attention remains in a condition of less sensibility, and the same is true of anæsthesia. The attention contracts the field of consciousness. At the same time, among hysterics chiefly, at the side of the normal personality, a subconscious personality, with which we can communicate and obtain responses, develops itself. For this person the anæsthesia does not exist: it itself remembers what it has done, and can receive suggestions. In writing, it uses the word 'I' to designate itself, and speaks of the normal self in the third person.

A second self, formed by the aid of diverted attention, does not make one with the self of the anæsthetic and the self of the somnambulist. The proof for this is easy. The self of the subject in somnambulism can repeat the names spoken to the second self in the state of diverted attention. Suppose the subconscious personality has been created by an involuntary suggestion of the operator, it nevertheless remains true that the disaggregated psychic phenomena have grouped themselves around a new centre.

The subconscious self is frequently a colaborer with the normal self. The voluntary movements of an anæsthetic member survive the loss of the consciousness of passive movements. The question, from the point of view of psychology, is very obscure, for the reason that anæsthesia of any sense, with rare exceptions, induces the loss of memory of the corresponding images. Therefore, the individual affected cannot represent to himself beforehand the movement to be performed. On the other hand, no afferent sensation can inform him as to the position of his limb. Subjects frequently say they represent to themselves, visually, the movements of the hand concealed behind a screen—deceiving themselves again. They are often deceived, while it writes, as to what letters it is tracing at any given moment. Therefore, no definite image remained in the normal personality, as a visual memory which guided the voluntary movements of the anæsthetic limb either well or ill. One is therefore obliged to admit the existence of sensations and kinæsthetic images in subconsciousness, to explain the co-ordination of these movements. The normal self commands actions which the subconscious self carries out.

Moreover, a conscious mental representation can excite subconscious movements without the knowledge of the subject. This fact is shown by the phenomena of automatic writing. The subject is asked to tell his age. He does so, and the pencil which has been slipped into the anæsthetic hand writes the same response. The movements of writing cannot thus produce themselves. The sensations and ideas of the principal consciousness determine the different effects within

the second consciousness. An hysterical patient hears the strokes of the metronome. Between her fingers is placed a tube of India rubber wound round a cylinder, so arranged that the rubber yields at each beat. The patient is told to think of a number. The anæsthetic hand makes the corresponding number of strokes.

We have considered the action of normal consciousness upon subconsciousness. Binet next considers the inverse phenomena. The sensations coming from the anæsthetic regions remain unconscious, but may penetrate the normal consciousness under the form of images, ideas, and false perceptions or hallucinations.

For example, we may prick an anæsthetic hand nine times. The subject has no consciousness of the pricks, but he thinks the number nine. He is also able to see points, bars, and columns, corresponding in number to that of the stimuli. He also exhibits the transposition of sensations. Binet hung around the anæsthetic head of a patient a medal with the design in relief. The subject said immediately that she was dazed, that she saw bright spots in the form of a circle. When asked to state what she saw, she related exactly (much more exactly than a normal subject could afterwards do) the details of the design, although the subject was an entirely strange one to her. This experiment indicates on the part of unconsciousness a quite remarkable activity of perception.

"The dividing of consciousness, therefore, is not by a sharp line of demarcation, suspending all relations between the consciousnesses," writes Binet. "On the contrary, the psychological phenomena of each group exercise a constant influence upon those of the neighboring group. The division leaves unimpaired the automatism of mental images, sensations, and movements. It consists solely in a limitation of consciousness. Each ego knows only what transpires in its own domain."

Binet next shows that there may be a plurality of consciousnesses in normal subjects. The phenomena above referred to have long been observed with nearly the same results, but less marked, in the cases of normal subjects. Their unconscious movements should be considered, it seems, as the effects of a very slightly marked mental duplication. When an individual is told to divide his attention so as to do two things at once—for example, to talk and to draw—it often happens that he directs his thought to one of the actions and performs the second automatically. Indeed we may sometimes, in the case of a normal subject, obtain a complete diversion of the attention and establish by means of automatic writing a division of consciousness analogous to that described above.

XUM

Suggestion is ordinarily followed by a division in consciousness. Here suggestions tending to create a new personality may be distinguished from those whose end can only be accomplished by a division of consciousness. In the first case the observer bids the subject assume this or that personality. Richet has thus made his patients, A and B, take the characters, successively, of peasant, actress, general, priest, nun, sailor, young woman, and little girl. The subjects retain their hallucinations along with their adopted characters. Their faculties of perception and ideation are perverted to the same standard, and whatever might contradict the suggestion of the operator is cast aside and banished from consciousness. In a similar manner the subject may be carried back to a previous stage of existence. In such a case many things return to the memory which in the normal state had fallen into utter oblivion. From this we may infer that the limits of our personal and conscious memory are not absolute. "What we know of ourselves," says Binet, "is but a part and perhaps an extremely small part of what we are." The laws of association fail to explain how it is that the things which have been kept in memory do not awaken at the stimulus of new impressions to which they should respond. Causes the most profound, because unconscious, are operating to distribute our ideas, perceptions, and mental images in syntheses at once automatic and independent. In the case of post-hypnotic suggestions the subject fails to perceive the hallucinations of his normal personality. For cases of long-deferred suggestion some explanation must be offered as to how the subject is able to calculate the time. It is still the subconscious personality that here intervenes, that keeps mental images in the given order and reckons the days and hours. In fact he can make these judgments as well as one who has actually passed through the experience. We say to the subject of double personality, "When the sum of the numbers which I am going to pronounce amounts to ten you will raise your hands." We murmur 2, 3, 1, 4, and the movement is made. Such phenomena, therefore, ordinarily take place unconsciously.

The subject of Systematic Anæsthesia yet remains. It is suggested to a subject that on his awakening he will not see a certain person, who, however, remains near him. His vision remains unimpaired, but the subject insists that the person in question is not there. The phenomenon is exceedingly complex. "The inhibited perception continues to manifest itself, but it remains unconscious. The subject seems to possess an intelligence different from the normal self, which decides whether he shall choose this or that." The facts of spiritualism and of the varying personalities which mediums claim to exhibit are explained by a division of consciousness accompanied by auto-suggestion.

Binet's conclusions are as follows: 1. The elements entering into the normal constitution of self may exist in a state of disaggregation. 2. A consciousness continues to accompany these elements, although the self loses knowledge of it. 3. Sometimes under pathological or experimental conditions these elements organize themselves into a second personality.

Binet's work is an extremely interesting study of the phenomena of subconsciousness. Psychology extends to the limits of definite consciousness and normal personality, the unity of which—Binet and Ribot being here in accord—should be sought for only "in the co-ordination of a certain number of psychological phenomena during a certain time." The hypothesis of subconsciousness, Huxley's adherents will say, is unnecessary. The physiological mechanism will account for everything. Is it true that the explanation is sufficient when the subject writes with an anæsthetic member an entire page in which the ideas follow one another in the proper order? Language, whether written or spoken, of course fails to explain either consciousness or personality. But what is the difficulty in admitting the existence of a second personality, when such personalities are produced spontaneously in some subjects? For cases of adaptation, and especially for those of repetition, we may appeal to muscular habit. But if the fact of subconsciousness has been proved, is it not natural to believe that, beneath the threshold of personal consciousness, lesser stimuli, down to a certain minimum, give rise to the phenomena of subconsciousness? It is rather the mental *nothing* which it is difficult to conceive. To say that beneath a certain stimulus all consciousness vanishes is to dig around consciousness an arbitrary ditch.

Are the subconscious phenomena necessary to explain the cases of repetition and adaptation connected with a secondary self? This question is very obscure. The second part of Binet's conclusion seems correct in the terms in which he has expressed it, and we agree with the author. But it seems to us that he here recedes a little from some of his more decided positions in the body of the work. Isolated subconscious sensations are productive of nothing. But are not the elementary syntheses of psychic phenomena enough to explain the simplest facts, the repetition in writing a letter, the resistance of the anæsthetic arm to strong pressure, its obedience to a moderate one, and even the act of pressing the dynamometer? May not the rectification of a fault in spelling be explained by the facts of motor habit? We hesitate to attribute to subconsciousness an established organization and definiteness analogous to that of normal consciousness when a secondary personality has not been clearly proved.

On the other hand, we hold with Binet that the phenomena pertaining to our normal personality remain in a state of disaggregation. As we go through life certain of our natural propensities fall into desuetude, certain mental images of past experience sink into oblivion. Our self is being made over anew. But nothing perishes that has once existed, and the past can be restored to life. Our consciousness reveals but a tiny part of what we really are, and "consciousness slips away and is lost by imperceptible transitions." * T. COURTIER.

SORBONNE, PARIS.

État mental des hystériques : les stigmates mentaux ; État mental des hystériques : les accidents mentaux. PIERRE JANET. Rueff, Paris, 1892, 1894. 2 vols., 12mo. Pp. 233, 304.

L'amnésie continue. PIERRE JANET. Revue générale des sciences, 30 mars 1893.

M. Janet is a *vielseitiger Mensch*, being now an M.D. and visiting physician at the Salpêtrière, without having ceased to be a Professor of Philosophy at the Collége Rollin. The present volumes continue the line of observation and reflection so brilliantly begun in his earlier work, *L'automatisme psychologique*, and may be said to set the seal on the revolution which during the last decade has been going on in our conceptions of hysterical disease. Amongst all the many victims of medical ignorance clad in authority the poor hysteric has hitherto perhaps fared worst; and her gradual rehabilitation and rescue will count amongst the philanthropic conquests of our generation. At first branded as one inflamed with uterine furor, she was next burned as a witch, and finally treated as so radically perverse and mendacious a jade as to be theatrical even in the hour of death. Now, thanks first to Charcot, Janet, Pitres, Gilles de la Tourette, and in a less degree to many others, she or he (for hysteria is now allowed to be a male complaint) can be regarded as estimable morally, and only pitied as one subject to a curious form of weakness of the intellect.

The weakness in question is described by M. Janet substantially as follows. In the constitution called hysterical the threshold of the principal consciousness is not fixed, but movable. It can be shifted by physical and moral shocks and strains so that sensations and ideas of which the patient ought to be fully aware become 'subliminal,' or buried and forgotten, and in this parasitic state persist more or less monotonously. The nucleus of these subconscious fixed ideas usually consists of reminiscences of the shock by which the mind was originally shattered; but in process of time other painful reminiscences

* Translated by C. A. Tawney, Fellow in Philosophy in Princeton College.

may be added, and accidental associations may complicate the system which, from its hiding-place below the principal consciousness, may produce effects of the most baleful sort upon the latter, effects irruptive (hallucinations and motor impulses) as well as subtractive (anæsthesias, amnesias, aboulias, confusions, etc.), and moreover may influence the bodily functions in manifold and formidable ways.

M. Janet proves the existence of these fixed ideas by many methods, by hypnosis, by automatic writing, by the hallucinations that come out in 'crystal-gazing,' by the patient's talk in sleep, by utterances during the 'attack,' and finally by what he calls the 'method of distraction,' which practically is only a variety of automatic writing. In these circumstances hysterics will reveal obsessive memories and ideas of which their principal consciousness is wholly unaware, and will explain in detail the images by which their various symptoms are determined. The most general morbid result, or stigma, from which they suffer is a *narrowing* of their principal consciousness, to which narrowing M. Janet more or less successfully ascribes the various defects by which the 'hysterical' character is popularly known: vacillation, inconsistency, revery, lack of will and of power of attention, enfeebled memory, and *ennui*. He shows us one woman acquiring accidentally these symptoms in consequence of certain ideas which she had received during hypnosis, and which remained subliminal after she was awake; and another reacquiring lost memories and will-power *pari passu* with the destruction, by suggestion, of her subliminal delusions. The anæsthesias, so characteristic in hysteria, he explains as acquired habits of ignoring certain sensations, which thus get handed over to the subliminal self. That they are false anæsthesias, and that the sensations of eye, skin, or what not, which appear non-existent, are really there, though hidden from view, is, thanks to Binet, Bernheim, Janet, and others, one of the most securely established facts of recent psychology. The most immediate result of this disintegrated condition of the mind is *suggestibility* on the subject's part, concerning which phenomenon M. Janet's second volume contains some very acute pages of psychological reflection. An idea implanted in such a mind develops its own eccentric consequences in a way impossible where the mental elements are more firmly knit together.

Grafted on this general background are the more fluctuating 'accidents' of the malady. The subterranean ideas and memories have periodical eruptions which constitute the well-known hysterical 'attacks.' Of what possesses the consciousness during an attack the patient can generally give no account when it is over; but the emotional attitudes and ejaculations of which it consists, and the causes which may provoke

it, show, when combined with the somnambulic and other revelations, that its nucleus is an hallucinatory re-enactment of the shock from which the whole morbid history dates. Thus George has an attack if you show him a lighted match, or if he looks at the fire in the stove. In this attack he shouts 'fire' and calls on the *pompiers*. He became ill after a fright caused by a fire; Alz . . . had his shoulder wounded in an elevator-accident, and now, if you touch the place, you provoke an attack characterized by terror of being crushed; Renée has a classical complex attack of 'grande hystérie,' of which most of the elements can be traced to reminiscences; she mews like a certain cat that startled her, and barks like a dog that she detested when a child; she imitates a little idiot at whose sight she was once horrified; she strikes an attitude that copies the posture of 'Truth' in a picture in her room; Marcella has hallucinations which reproduce painful experiences—in short, the attack is everywhere essentially a reminiscent dream. Charcot's 'complete' attack is no special natural entity, but only a dream due to the association into a system of a number of different morbid memories. The ideas may be stratified, as it were: "Is . . ., as a result of having been violated and having clandestinely had a child, first manifests refusal to eat (subconscious fixed idea of suicide), later is irascible and violent (subconscious idea of homicidal revenge), and finally, whilst apparently well, has a *bizarrerie* which remains, and consists in her inability to bear the sight of little children. She is impelled to beat them; and if they remain long in her presence she goes into an attack (subconscious aversion to a child as the cause of her disgrace). The case of Marcella, published three or four years ago by Janet in the *Revue philosophique*, is a beautiful example of stratification in fixed ideas. As each one was removed by suggestion, a deeper and older one came to the surface and worked itself off, until with a final outbreak of suicidal frenzy, the girl got entirely well. The fixed ideas may slumber until some weakening of the nervous system favors their morbid activity. E.g., Col. is victim of a railroad accident, and passes six months in the hospital with a grave abdominal injury. During the next six years he seems well, save that he can no longer get drunk as he formerly did, for, if he does, he raves of the accident and suffers cruelly in his abdominal wound. At the end of six years he undergoes domestic calamities, witnesses the death of wife, child, etc., whereupon depression, revery, incapacity for work, set in, and he comes again to the hospital with a meteorized and hyperæsthetic abdomen, which M. Janet does not hesitate to ascribe to subconscious reminiscence, for if the old scar be touched an hysterical attack is provoked, consisting in hallucinations of the railroad tragedy.

Spasmodic disorders, *tics*, as the French call them, are among the commonest hysteric symptoms. These also, according to M. Janet can be traced to subliminal ideas. The girl Mel . . . has a choreic movement night and day, which imitates movements that she daily has to perform in her factory. Doing it in her sleep she murmurs, '*il faut travailler, il faut travailler*,' and the whole thing is finally explained as the result of her having overheard, whilst lying half-awake, her parents lament their poverty and inability to pay their rent. "A simple procedure cured this chorea, due to filial piety." Vel . . . for eight years has had a particularly odious tic, consisting in an expulsion of air through the nose, and a contortion of one side of the face. This resists every conceivable treatment, and for the patient's consciousness is irresistible and motiveless. The moment he is hypnotized, however, he says, '*j'ai une croûte dans le nez; elle me gêne*'; and a corrective suggestion then made abolishes the symptom. It would appear that the subconscious delusion here dated from certain nose-bleeds in a typhoid fever eight years before.—And so we are led by our author through the whole train of hysteric symptoms. The paralyses are interpreted by him as amnesias of certain kinæsthetic images, when they are not results of subconscious delusion; the 'contractures' come from fixed ideas; so do the dumbnesses and refusals to eat. Isabella cannot eat. She knows not why, but it appears that during each of her 'attacks' her dead mother appears to her, upbraids her for a past misdemeanor, calls her unworthy to live, and forbids her to take food. Similarly Marcella's anorexia comes from a voice which she hears during her attacks and which orders her to starve.

Our space permits no more details, but the reader can already see how rich a mine both of new facts and of new ideas Dr. Janet's little volumes are. Every psychologist should make their acquaintance. Their author's intellect is, if anything, too inductive; he is never quite at ease when away from one of his concrete examples, and he cares perhaps too little for things unlike what he has himself seen. But these are the only faults I can find with his work. He has certainly established his main point, and the class of cases which he describes will hereafter rank as real. But they are all grave cases, where the patients were *non compos* and had to be taken care of at an institution. How far their type can be generalized, and how far the milder cases met in private practice will also be found to suffer from split-off fixed ideas, remains for the future to inquire. According to all past analogies, what will probably happen is that the morbid type conceived by M. Janet will undergo both restriction and extension. In certain kinds of so-called hysteria no subliminal ideas will be ascertained; whilst such

ideas probably will be ascertained in cases not easily recognizable through their other features as similar to those which M. Janet cites. At any rate this observer has set a great ball rolling, and it is to be hoped that he will be able to continue playing an active part in the superintendence of its career. W. J.

Ueber den psychischen Mechanismus hysterischer Phänomene. J. BREUER und S. FREUD. [Mendel's] Neurol. Centralbl., 1893, pp. 4, 43.

"Hysteria is a disease of the hypnotic stratum," wrote Mr. F. W. H. Myers many years ago, and this important paper is a comment on his dictum and an independent corroboration of Janet's views reported above. The distinguished Viennese neurologists who sign it stumbled accidentally on cures which enable them not only to give a general formula for the disease, but a general method for its treatment. Hysteria for them starts always from a shock, and is a 'disease of the memory.' Certain reminiscences of the shock fall into the subliminal consciousness, where they can only be discovered in 'hypnoid' states. If left there, they act as permanent 'psychic *traumata*,' thorns in the spirit, so to speak. The cure is to draw them out in hypnotism, let them produce all their emotional effects, however violent, and *work themselves off*. They make then (apparently) a new connection with the principal consciousness, whose breach is thus restored, and the sufferer gets well. Janet's Marcella, mentioned above, would be a case in point. W. J.

The Philosophy of Mental Healing: a practical exposition of natural restorative power. LEANDER EDMUND WHIPPLE. Metaphysical Publishing Co., New York, 1893. 8vo. Pp. 234.

It is but just to our American mind-curers of the various sects to say that for years past the notion that all sorts of morbid symptoms may spring from subconscious fixed ideas, such as old fears, griefs, and remorses, has been the basis of their treatment. Mr. Whipple's book sets forth this notion in an earnest way, in the good English of an educated man. Although the theoretic exposition seems to the more carnal and school-bred mind of the present reporter to lack technical sharpness, it is much more assimilable than any previous statement which he has read. The most striking feature of the book to him is a list of cases which the author gives at length. Neuralgia, rheumatism, bronchial catarrh, debility, nervous agitation, chronic diarrhœa, insomnia, dyspepsia, and chills are shown, in as many patients, to have arisen from subconscious or conscious fixed ideas, which being scattered,

recovery ensued. The author well says that, in patients of this sort, to treat the mere external symptom would be as bad practice as for an engine-driver to slow his engine by scotching the wheels and pistons rather than by regulating the steam-box or the boiler. Yet in cases of refusal to eat, like those quoted from Janet in the last review but one, the only practice known at an ordinary asylum is forcible feeding by the stomach-pump. It is to be regretted that Mr. Whipple gives no detailed account of the practical method by which the fixed ideas are to be pulverized away. In most 'metaphysical healing' it seems to involve something like the telepathic action of one subliminal self upon another; but with this we navigate in full wonderland, where without safe guidance we had better not proceed. W. J.

THE PERCEPTION OF LIGHT AND COLOR.

Zur Farbenperimetrie. EMIL HEGG. Arch. f. Ophth., XXXVIII. (3) 145. 1891.

Eine Methode der objectiven Prüfung des Farbensinns. M. SACHS. Arch. f. Ophth. XXXIX. (3) 108–125. 1893.

The experiments of Hess (Arch. f. Ophth., XXXV. 4, 1889) have made it plain that there are certain colors which do not change their tone as they are viewed by portions of the retina more and more remote from the fovea. These colors are (with slight variation due to individual differences in the retina and to changes in the objective illumination): yellow (575$\mu\mu$), green (495–497$\mu\mu$), blue (471$\mu\mu$), and a red somewhat more blue than the spectral red; and these colors are called by him, in correspondence with this fact, the invariable colors. Yellow and blue are visible farther out upon the retinal field than red and green; from this fact it follows that a mixture of red and yellow will begin to lose its red constituent first and will grow yellower before it grows colorless, and that, in the same way, all colors except the invariable ones are subject to changes of tone as they approach the periphery. These facts have been confirmed by several other observers (the writer has obtained the same results, as regards the spectral colors, in Prof. König's laboratory). It will therefore be necessary, hereafter, to replace the vague statements in regard to change of color which are now to be found in the text-books by this more definite knowledge. Emil Hegg, in pursuance of the subject, has been able, after overcoming many difficulties, to first prepare upon the color-wheel, and then to reproduce in paint upon tin plates, colors which have these properties: 1. They are invariable in tone. 2. Their

XUM

saturation is such that *equal* sectors, mixed upon the color-wheel, give gray. 3. When observed in the extreme periphery of the eye, when they are colorless they are of equal brightness. Colors thus prepared are found to be, as might be expected, extremely well adapted to detecting localized defect in color-sense in diseased retinas, and hence are very useful for the practical oculist. They may be obtained from Herr Maler Lauterburg, in Berne.

The writer of this paper shows a confusion in the use of the term brightness which is not uncommon among the followers of Hering. Colored papers which look equally bright when colorless he sometimes refers to as having equal white valence, which is correct for one who admits the existence of a separate process for white; but again he speaks of them as being simply equally bright, and he says (p. 149) that colors can be compared with each other as regards their brightness-value by means of the Hering screen used in Hess' experiments already referred to. This is not correct. It is now some time since Hering has remodelled his theory in such fashion as no longer to say that the brightness of a color-sensation is simply its accompanying whiteness, but rather that the color-process adds a specific amount (positive or negative in quality) to the total brightness-effect. This is, of course, a provision which he should have incorporated into his theory in the beginning, had he not remained, apparently, for many years oblivious of the well-known Purkinje phenomenon. It is therefore not possible, theoretically, to say that colors are equally bright because they look equally bright when the illumination is very faint, or when they are seen in the extreme periphery of the eye; nor is it true as matter of fact. On the Chevreul brightness-scale, which gives twenty-one steps between black and white, Hillebrand found that the colors had to be moved (up or down as the case might be) from three to six steps according as the comparison took place in a bright or in a faint illumination. (*Specifische Helligkeit der Farben*, Ber. d. Akad. d. Wissensch. in Wien, XCVIII. 3, 1889.) And from this it follows also that color-value (*Farbenwerth*) is a term whose meaning may easily become ambiguous; it might as readily mean the specific brightness due to the color-process as the power of quenching its antagonistic color and producing white. It is in the latter sense that Hegg uses it. It might perhaps be better to adopt this phraseology: two different colors (in the general sense) have equal white-value if they look equally bright in the dark; they have equal color-value if they *also* look equally bright in a good light (but from the fact alone that they look equally bright in a good light it does not follow, of course, that their white-values and their color-values are severally equal); they have equal

color-quenching value if equal portions of them, mixed on the color-wheel, make white (gray).

In continuation of his former work (*Pflüger's Archiv*, Bd. 52, pp. 79-86) in which he showed that the width of the pupil varies very exactly with the subjective brightness of the light which falls upon the eye, Dr. Sachs has tested the method as a means of detecting color-blindness, both partial and total, and has found it to be very effective. The person to be examined looked at an opening in the window-shutter of a dark room, which was covered in succession with different gray and colored glasses, and the varying width of his pupil was observed with the aid of a telescope. Two glasses were selected which were of equal brightness for the normal eye in an illumination so faint that their color was not perceptible,—which had, that is to say, equal white valence. At an ordinary illumination these proved to be of very different brightness for the normal eye, as indicated by width of pupil as well as by sensation, but for the totally color-blind person no illumination could be found at which they affected the pupil differently. A red-green blind person was also examined, with the result that to blue and yellow glasses he reacted like a person with normal eyes, while red and green left him with width of pupil unaltered. An instructive experiment was the following: a red or yellow glass was found which, while it had less white valence, was brighter for the normal eye than a given green or blue; the change from one glass to the other caused the pupil of the totally color-blind person to contract and that of the person with normal vision to widen. The method would be of special value for testing persons of defective intelligence, deceitful or hysterical persons, and infants. It ought to be used at once to determine the question whether the color-sense is developed in infants later than the sensitiveness to changes of brightness of white light.

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BINOCULAR VISION.

Die Stabilität der Raumwerte auf der Netzhaut. FRANZ HILLEBRAND. Zeitschr. f. Psych., v. 1–60. 1893.

The problem which this paper attempts to solve is thus stated: Are, for all cases of binocular single-vision, the space-values of the two retinas stable or otherwise? Historically this question has been answered in both ways. The older 'projection-theory,' that an object is seen at the intersection of the lines of regard, involves variability of space-values; for if for one distance of the fixation-point these lines

fall upon retinal points a and a', for any other distance, if one line falls upon a, the other cannot fall on a'. Hering, on the other hand, maintains that the localization of a point depends, not on the point of intersection of the lines of regard, but on the space-values of the two retinal points affected.

Experiments to decide this question must consider only *primitive* sensations (those given by retina and muscles), unmodified by empirical elements (perspective, size of retinal image, etc.) which aid in localizing with reference to the horopter. Such empirical aids as affect the apparent distance of this surface itself are irrelevant, since we have to consider only whether particular objects appear in front of, in, or behind this surface. The experiments must separately decide as to whether the variability, if it exists, is horizontally disparate, or vertically disparate, or both.

To determine the first of these questions, three vertical cocoon-threads were used, their supports being made invisible by screens. The two outermost were fixed at like distances from the frontal plane; the middle one was to be so placed that it appeared in the same plane, the eyes being fixed and symmetrically converged. Under these conditions the middle thread must actually lie behind the plane of the other two, if they are near the eye of the observer, in front of it if they are farther away. That is, the vertical horopter is only at one particular distance a plane; nearer, it is a surface concave toward the observer; farther away, convex.

This fact, as the author shows at length, *can* be explained under the assumption that retinal space-values are stable, provided we assume that, of the angles formed in each eye by the two lines of direction with the line of regard, the nasal angle is constantly greater than the temporal. Helmholtz, however, believes that it admits of explanation only under two assumptions: (1) a falling away of a vertical disparity, which when present corrects the illusion; (2) a false estimation of distance. This explanation involves the assumption of *variable* space-values. Its two parts are separately examined.

1. If very minute scraps of paper ($\frac{1}{2}$ sq. mm) were fastened in irregular order on the vertical threads, thus furnishing the otherwise lacking vertical disparity, this new factor made no difference in the results; the placing of the middle thread remained as before. So, too, if the threads were made invisible, a single bright scrap being fastened on each at different heights. The same was true if horizontal threads were placed directly in front of the three vertical threads (again visible, and without the paper scraps). But if the apparatus was so arranged that the pushing back of the middle vertical thread carried

back with it the middle parts of the horizontal threads, the result was changed: they no longer appeared in a plane when in the same position as before, and it was impossible to find a position in which they did so appear with any definiteness.

The other experiments prove that the vertical disparity given by the horizontal threads cannot account for the results obtained in this last experiment. Their explanation lies rather in the fact that the pushing back of the horizontal threads gives an *empirical* factor, namely, perspective, which influences the estimation of distance. But, as was pointed out before, not empirical factors, but only the primitive sensations, have value in deciding the main question. Now in the experiment on which Helmholtz relies to prove the influence of vertical disparity, gold pearls were so fastened upon vertical threads that the resulting estimations were based, not upon this disparity, but upon perspective, and perhaps to some extent on size of retinal images: both of them empirical factors. The same is true of Helmholtz' experiment with stereoscopic figures. It is clear, then, that vertical disparity is without influence on localization in distance.

2. The second factor in Helmholtz' explanation is that the false estimation of the distance of the middle thread causes us to make a corresponding false judgment as to the relative position of the side threads. In case there are no vertical disparities present, the judgment must be determined by this factor alone. There are two types of illusion with respect to distance of objects: (*a*) when the fixed point is localized in accordance with the convergence of the eyes, but this convergence is not adjusted to the real distance of the object, e.g., by the use of prisms, etc.; (*b*) when the localization does not accord with the convergence, even when this is adapted to the actual distance of the object: when two stereoscopic pictures are joined, the object does not appear at an infinite distance. These two cases must be separately experimented with to see if they support Helmholtz' conclusion. And in these experiments we must take care that the retinal images suffer no change, in spite of any other change in the conditions of the experiment.

(*a*) If two systems, each of three vertical cocoon-threads, are looked at with parallel lines of regard, and thus fuse into apparently one system, its apparent distance will coincide with that of a screen which may be placed at varying distance behind them. Thus the convergence remains constant, while the apparent distance varies. If then the middle thread be so placed that it appears in the plane of the other two, it still appears in that plane if the apparent distance of the plane is changed. When the convergence remains constant, the

form of the vertical horopter is independent of the apparent distance of objects lying within it.

(*b*) By the use of a haploscope specially designed for the purpose, it was proved also that when the apparent distance remained constant or very nearly so, the greatest possible variation in convergence was attended by no change in localization with reference to the horopter. All the illusions appealed to by Helmholtz can be reduced to one of these two types, or to a combination of both. In one experiment by Helmholtz, however, namely, that with prisms (*Phys. Op.*, p. 657), the localization with respect to the horopter does vary when the convergence varies; but this is due, not to the variation of convergence, but, as is shown by an extended examination of the influence of the reflections and refractions of the prisms, to variation in the retinal image of one eye,—a factor which causes such results even without change in convergence.

These facts, then, prove that the localization of a point relatively to the horopter must be regarded as a physiological function of a particular pair of retinal points. To such a pair we can ascribe a space-value and maintain that this space-value is stable. As Hering had already assumed, in order that a point seen by such a retinal pair may appear in the horopter, the two lines of direction of the external point must form with the corresponding lines of regard angles of which the nasal must be greater than the temporal; i.e., breadth-values increase faster on the outer retina than on the inner. This agrees with the fact that, in monocularly bisecting a line, the portion whose image falls on the inner retina is made longer than the other. Finally, binocularly singly-seen objects are not seen at the point of intersection of their lines of direction; the position of the visual object does not coincide with that of the corresponding real object. But this illusion is not an illusion of judgment in regard to the content of sensation, as Helmholtz thought, but one in regard to form and situation of the actual object.

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ÆSTHETICS OF FORM.

Zur experimentellen Aesthetik einfacher räumlicher Formverhältnisse. LIGHTNER WITMER. Philos. Studien, IX. 1. 96–144, 2. 209–263. Also separately published by Wilhelm Engelmann, Leipzig.

The author of this investigation made use of figures cut from cardboard—rectangles, triangles, etc.—and of simple linear figures drawn on paper—crosses, rectangles, vertical lines divided by dots, and others.

All the figures of a single group or series were placed before the subject in a serial order such that the mathematical proportions of the parts of the figures varied by a constant amount between the ratio 1 : 1 and 1 : x (x being any large number). For example, in a series of crosses comprising perhaps 20 to 30 crosses, the length of crossbar and vertical remaining constant, the crossbar moved 1 mm in each figure from the centre point of the vertical to a point 1 mm from the top of the vertical. As far as practicable or necessary for the purposes of experiment, every possible mathematical ratio is represented by a figure, whose place in the series is determined by the mathematical proportion of its parts. This method permits of the easy observation of the relative increase or decrease in the æsthetic feeling attaching to the regularly-increasing proportions, and is not open to certain objections that may be made to the method of choice as applied by Fechner to arrive at the æsthetic value of the 'golden section' and the simple mathematical proportions of the musical harmonies. Each series comprised from 15 to 30 figures, and results are given in detail from 65 series. Other series were constructed and used, but no report is given of results, as it was found that those series in which the linear magnitudes under consideration did not stand at right angles carried the investigation too far afield, through the multiplication of variable conditions.

The 65 series are classified under the following groups: 1. Proportional division of a straight line (13 series). 2. Two lines meeting to form a right angle (2 series). 3. A line perpendicular to a second line at some point other than the ends of the latter (8 series). 4. Cross-figures (11 series). 5. Various inclosed figures—ellipses, rectangles, triangles (12 series). 6. Multiple proportion in simple figures (7 series). 7. The same in more complicated figures (7 series). 8. Figures to investigate the dependence of the pleasing quality upon absolute size. Of these groups 1, 2, 4, and 5 form the experimental basis for the main conclusions of the investigation, but all groups are reported upon, and the results tabulated, with no omission of individual variant results. Sixteen tables present the results of the judgments of the 14 subjects taking part in the investigation. An additional table gives the average variation of the individual judgments of each of seven subjects from the average judgment of each, and the average departure of the judgment of each subject from the average judgment of all subjects. A section of the paper is devoted to some hitherto unpublished experiments of Fechner's, presented with three tables of results from manuscripts kindly loaned the author by Frau Fechner and Fechner's literary executor, Prof. Dr. Kuntze. Another section concerns itself

with a theoretical consideration of methods, containing also six tables of control experiments. Still another is devoted to a consideration of Fechner's methods; another to Zeising's speculations and investigations; an introductory section to a short historical review, and a final section to a consideration of possible interpretations of the results.

These results go to show that the æsthetic value of simple visual forms may be represented by a curve—the abscissas representing in regular succession all proportions from 1 : 1 to 1 : x (x being an indefinitely large quantity), and the ordinates denoting the degree of subjective pleasure or displeasure (agreeableness or disagreeableness) attaching to a given proportion; or, looked at from another point of view, the objective æsthetic value of the proportion. For all groups of figures and for all positions of the figure there are but two even relatively most pleasing proportions—the ratio 1 : 1, or *symmetry*, and a ratio that lies between 2 : 3 and 1 : 2, the '*most pleasing proportion*,' to designate which the author suggests a symbol ○, to be distinguished from Fechner's symbol ⊙ for the mathematical ratio of the harmonic section. The curve begins as a straight line at 1 : 1 (which represents that a range of ratios is perceived as 1 : 1); it is interrupted, to begin with a negative or diminished ordinate value at a ratio that appears just 'off' from 1 : 1 (about 1 : 1.18 in rectangles); from this point the curve rises to a maximum at 1 : 1.63, whence it falls gradually but continuously to 1 : x. Symmetry in all figures stands so apart from all other proportions that a comparison between it and any other proportion on the same terms as between the other proportions among themselves is not justifiable. Cutting off the straight line of the subjective ratio 1 : 1, the remainder it is proposed to call the 'curve of æsthetic proportion.' The maximum of this curve in nearly all series falls between 1 : 2 and 2 : 3, and the average of all results places it so near the 'golden section' (○ = 1 : 1.63 and ⊙ = 1 : 618) that this formula might justifiably be employed to express in mathematical terms the 'most pleasing proportion.' But its use would be in so far objectionable, as it would carry with it the implication that the æsthetic value of the 'most pleasing proportion' is dependent upon the mathematical properties of the golden section. If the 'most pleasing proportion' is to be expressed in mathematical terms, the ratio 3 : 5 is suggested as being an approximate expression of the results of this investigation, free from unnecessary and false implications.

Summarized, the results of this investigation are as follows: 1. The most pleasing proportion is a ratio 1 : 1.63, or expressed in whole numbers, approximately 3 : 5. In reality it is more correct to speak of a range of most pleasing proportions, as the curve falls but slowly to both

sides of the maximum. 2. Symmetry and Proportion are æsthetically quite unlike, and their pleasing character is due to wholly different causes. 3. The pleasing character of proportion is not to be explained by any association either in the individual or in the race. 4. An explanation of the 'most pleasing proportion' is not to be sought in the mathematical qualities of the 'golden section,' i.e., in an equality of ratios. 5. Still less is the assumption justifiable of a mathematical formula as the mystical constructive principle of the universe, the more perfect expression of which constitutes the basis of the beauty of visual forms. 6. To consider æsthetic proportion as a '*most pleasing difference of parts*' is justified by the results of the present investigation. 7. No explanation is offered to show why just this amount of difference is most pleasing; future analysis and experiment will probably unravel a multiplicity of factors, physiological and psychological.

AUTHOR'S ABSTRACT.

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MUSIC, SPEECH AND SONG.

Psychologie du musicien. L. DAURIAC. Rev. philos., XVIII. 449–470 and 595–617. 1893.

I. The Evolution of Musical Ability.—Music is not an imitative art. The so-called 'music' of birds consists of noises rather than tones; the discrete scale is a human invention. Music in its higher development is essentially modern. Historically, the composer and virtuoso precede the 'amateur auditor.' At present the 'amateur auditor' generally precedes the virtuoso, and the composer is the latest stage of all, though there is no strict law. The composer is so far influenced by the productions he has heard that they mould his style, without necessarily impairing his originality; this causes the historical progress in music and often produces local coloring.

II. The 'Ear for Music.'—The appreciation of differences in *pitch* is the test of musical appreciation. This seems to grow more delicate in the race and in many individuals. A false note is more readily detected (1) the longer the tones last; (2) the larger the number of concomitant tones; (3) the greater their intensity. Distinction of *timbre* is not essential to an ear for music; it is largely due to voluntary training. The difference between classic and contemporary orchestration is perhaps owing to our present greater knowledge of the physiological effects of various timbres. The ability to distinguish the relative *intensity* of tones seems to be always present. Some persons distinguish rhythm who confuse all airs having the same rhythm.

XUM

The writer distinguishes between *music-deafness* and *tone-deafness*. The former is inability to appreciate music (æsthetically), while distinguishing between tones; the latter is inability to tell tones apart.

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PRINCETON.

Internal Speech and Song. J. M. BALDWIN. Philos. Review, II. 385–407. July, 1893.

The author begins with the question: Can the speech-centre be innervated directly by the auditory or other sensory centres, or must the kinæsthetic word-centre always stand between? Surveying the evidence with some detail, he concludes that there may be a direct flow from the auditory or visual centre to the motor speech-centre, the kinæsthetic speech-centre not necessarily being excited on the way. Speakers are probably of two types, sensory and motor, the latter, judging by the analogy of reaction-time (which is usually more rapid when the attention is bent upon the movement), being presumably the more rapid in their utterance.

When a man is habitually motor or habitually sensory, is this because of a mere habit of his attention?—or are there native motors and persons who are natively sensory? Prof. Baldwin says that we cannot be *exclusively* either motor or sensory in our reactions because of the necessary neural circle by which all sensory attention overflows into motor adjustments that come back in turn in the shape of an augmentation of sensation. He formulates a 'law of sensori-motor association,' as follows: *Every sensational state is a complex of sensor and motor elements, and any influence which strengthens the one tends to strengthen the other also.* But our various attentions and memories do not develop simultaneously. Motor speech-ideas are preceded by visual ideas of objects, and these by auditory ideas of words understood. Thus the auditory and visual memories get a good 'start' on the motor ones. Unliterary people may sometimes remain 'audiles' all their life. Others, and these apparently the larger number, grow into motors. The reaction-time of a sensor will probably be shorter by the sensory method, that of a motor will be shorter by the 'muscular' method—thus Prof. Baldwin would explain the results of some recent observations which disagree with those at first obtained. Passing from internal speech to internal song, the author seeks a theory of tune-recall which shall account for our ideas of pitch, rhythm, and timbre. There is a motor type of musical memory which requires to think the words or hum the rhythm inwardly before the tune is realized in fulness. In some cases the tune must even be associated with a particular

instrument and with the movements made in playing it thereupon. But that this is only one type among many is shown by the fact that musical recognition and expression may precede verbal recognition and expression in childhood, and may be retained when the subject has fallen a victim to verbal aphasia, either sensory or motor. That musical recall can be auditory is also shown by other facts, especially those which relate to the recall of pitch. v. Kries considers that the 'absolute' recognition of a note's pitch is due to association with the note's name. Obviously it ends in this where the note is named; but Prof. Baldwin suggests that the deeper basis of mere recognition and mere recall of a note and its pitch as something familiar consists in the revival of those motor associates of the note which are involved in adjusting the attention to it. "When a presentation comes a second time into consciousness, it is adjusted to more easily because its apperception in attention proceeds upon a basis of ready-formed association. This relative ease of adjustment is felt as the subjective aspect of recognition."

This article (like much of its author's writing) is in places deficient in perspicuity. But it is important, apart from its richness in details, because it offers a basis of mediation between the two theories of Recognition over which Höffding and Lehmann have recently waged war. One theory, stated in its radical form, says that a thing looks familiar to us when it recalls to us its past *self*. The other theory says it looks or sounds familiar when it recalls its past *surroundings*. The difficulty with the latter view is that the supposed surroundings fail to become explicitly conscious where the recognition is confined to the bare 'sense of familiarity.' How do we know, then, that they are at all tending to revive? But Prof. Baldwin, in making them sink to the level of the mere motor associates of former acts of attention, gives a good reason why our consciousness of them should be so indistinct and why at the same time we should so unmistakably greet the sensory experience which they accompany as one already 'ours.' W. J.

EPISTEMOLOGICAL.

Die moderne Energetik in ihrer Bedeutung für die Erkenntnisskritik. KURD LASSWITZ. Philos. Mon., XXIX. Hefte 1–4.

The author adds in these articles another chapter to his history of modern atomism.* He had reached in his history the conclusion that physics find in the kinetic atomism an ideal carrier for its details.

* *Geschichte der modernen Atomistik*, K. Lasswitz, Hamburg, 1891.

The development of the theory of energy, especially that which it has received at the hands of Professor Ostwald of Leipzig, obliges him to at least restate this proposition if he is to justify it in the face of this most modern theory.

Herr Lasswitz prefaces his discussion by a deduction of the concepts of quantity and quality based upon a chapter of Dr. Natorp's *Logik*. Starting from the manifoldness and unity which are the fundamental aspects of all phenomena of nature, the author defines quantity as that property of things by which they may exhibit a difference without a change of the unit—the difference of magnitude. From the standpoint of quantity the possibility of comparison of things consists only in their manifoldness, in so far as multiplicity may be without difference. Quality, on the other hand, is that property which involves a difference of units—every quality is a law of the formation of a magnitude. In virtue of the property of quantity things differ only so far as they can be brought under a single unit; in virtue of quality things differ in so far as they must be brought under different units. The three categories of quantity are unity, plurality, and totality, in which the third category is result of combination of the other two.

Corresponding to these we have three categories of quality—identity, difference, and variability. These depend upon the fact that every qualitative phenomenon is a continuous one in nature. To obtain therefore a condition which shall be identical with itself we must have recourse to the infinitesimal concept. But even when asserting this as identical and therefore different from other states or conditions, we must define it by the law of the change from one state to another.

Color as a qualitative condition of things must be studied in the spectrum where it is a continuous phenomenon, continuous by changing from the most saturated red to violet. If by the infinitesimal concept we fix one portion as identical, we can define it only in terms of the law of change, as ordinarily expressed in the number of vibrations. This gives us variability as the concept of quality, by which it can be treated as a magnitude and so become an object of study for physics. States made up of like units and units constructed upon the concept of variability form the subject-matter of physics. This gives the phenomena of nature as categorically determined, but does not give it as actually existing. This element which involves the objective existence of a state or condition is energy. This is first defined as that magnitude in virtue of which equivalence exists among the 'forces of nature.' The three categories of relation which are postulated as involving existence are those of substance, causality, and system.

The author finds the reality of the category of substance in the conservation of energy, i.e., in the fundamental unity which must be posited as underlying all the manifoldness of the natural phenomena. The reality of the law of causality is identified with the law of the compensation of intensities which the theory of energy postulates as the law of all change. Two factors determine the amount of energy (*Energiemenge*) in any spatial configuration—its so-called capacity and its intensity. Given a number of energies—that of mass, of warmth, of electricity—any one spatial configuration may have relatively varying capacities for each or they may (as in many cases) be equal for a number. The intensity of this energy, however, may be in a state of constant change within the spatial configuration or between different spatial configurations or bodies. The heat may equalize itself throughout a single body or it may be received from another. On the other hand, the differences of intensities in different portions of a body may be compensated by different forms of energy. The condition, then, of any change will be that there be present uncompensated differences of intensity. The relative spatial positions of these differences and their varying intensities will determine the temporal order in which change shall take place. This law of the theory of energy, therefore, expresses the reality in the relation of cause and effect.

The general interrelations of the energies, the laws in accordance with which they are exchanged and compensate each other, and the fundamental principles of their action, give us in the third place an interrelation between the different objects whose substantial and temporal reality are given by the laws of energy, which the author expresses by the relation of system. The unified groups of objects which exist in the world—its organisms and systems—express this third relation; and by them the whole concept of reality is exhausted.

Instead, then, of the reduction of all the phenomena of nature to terms of mechanical physics, this theory of energy places the different energies upon an equality with each other—expresses each as a qualitative state or condition by the mathematical law of its process. The roundabout methods by which light and heat and electricity are reduced to facts of molecular motion or energy can be dropped, and the mathematically stated facts of each can be brought into correlation with each other by means of the principles of conservation and compensation. In the place of the mechanical unit, the gram, comes the erg, i.e., double the energy which a gram of weight possesses when it moves with the velocity of a centimeter in a second.

There are two difficulties which beset physics, in the light of which Lasswitz discusses this theory. The first is the imputation against

modern molecular physics that it arbitrarily reads all other sensations into those of touch, or contact. This imputation the author has strenuously denied in his history of atomism, and welcomes the theory of energy because it shows so clearly that no sensation is laid at the basis of the statements of physics, but that this science is a rationalization of the phenomena of nature in abstract terms—terms that abstract from all qualitative expressions except in so far as these can be found in the law of their changes or processes. On the other hand, the author is confident that the reduction of all energies to the terms of a single one will be a necessary development in the theory of energy, and that this will be the energy of mass in a molecular formation. The aim of physics to seek a unified statement of the world will drive the theory of energy into this. But the means for this expression which this theory offers, i.e., the terms of energies expressed in the formulæ of their laws of change, with the unity of the conservation of energy substituted for that of an underlying substance, he finds superior to those of the mechanical physics which hold the field to-day. The second difficulty is that of the expression of sensation in terms of motion: and here Lasswitz finds also that the theory of energy has removed inconsistencies that could not be avoided by mechanical physics. In the first place physics at once assumes the function of stating the phenomena of nature in abstract terms—those of the rational judgment—not in terms of an extra-existent substance which is read in terms of sensations of touch.

In the second place the unity of its determinations are those of the objectified subject. They are the laws of the content of consciousness abstracted from the ego at its centre. The fundamental inadequacy of the expression of sensation in motion is due to the abstract terms of the science. The question whether, wherever in nature unity in a system is found, we must suppose an ego also, the author leaves undecided.

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NEW BOOKS.

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NOTES.

THE AMERICAN PSYCHOLOGICAL ASSOCIATION.

The second annual meeting of the American Psychological Association was held at Columbia College, New York on Dec. 27th and 28th, 1893. In the absence of President Low the meeting was called to order by Professor Butler, Dean of the Faculty of Philosophy of Columbia College, who introduced the President of the Association, Professor Ladd of Yale University. There were in all five sessions,

extending from eleven o'clock on the 27th to half-past four o'clock on the 28th.

The following papers were presented: (1) 'The Psychological Standpoint'; Professor Fullerton, University of Pennsylvania. (2) 'The Case of John Bunyan'; Professor Royce, Harvard University. (3) 'Experiments on Visual Memory'; Mr. Warren, Princeton University. (4) 'The Confusion of Content and Function in the Analysis of Ideas'; Dr. Miller, Bryn Mawr College. (5) 'Do we ever Dream of Tasting?'; Professor Murray, McGill College. (6) 'An early Anticipation of Mr. Fiske's Doctrine as to the Meaning of Infancy'; Professor Butler, Columbia College. (7) 'Address of the President'; Professor Ladd, Yale University. (8) 'Accurate Work in Psychology'; Dr. Scripture, Yale University. (9) 'The Problem of Psychological Measurement'; Mr. Mead, University of Michigan. (10) 'The Perception of Magnitude and Distance'; Dr. Hyslop, Columbia College. (11) 'Pain and Pleasure'; Mr. Marshall, New York. (12) 'Pain Contrasts'; Professor Pace, Catholic University, Washington. In addition to these papers, which made up the official programme, informal papers were presented by Professor Münsterberg, Harvard University, Professor Cattell, Columbia College, and Dr. Scripture, Yale University, giving in each case an account of recent research.

Nearly as much time was taken up in the discussion of papers as in the reading of them. The members who took part in the discussion, in addition to those who presented papers, were Professor James, Harvard University, Professor Baldwin, Princeton College, Professor Starr, College of Physicians and Surgeons, Professor Dewey, University of Michigan, Professor Armstrong, Wesleyan University, Professor Strong, University of Chicago, Professor Krohn, University of Illinois, Dr. Witmer, University of Pennsylvania, and Brother Chrysostom, Manhattan College. There were in all thirty-three members present, representing sixteen of the leading colleges and universities of the United States and Canada.

At the business meeting of the Association it was decided to print proceedings, which should include short abstracts of the papers. Fourteen new members were elected, and Professor Dewey of the University of Michigan was elected a member of the council. Professor James of Harvard University was elected President for the coming year and Professor Cattell of Columbia College, Secretary. Accepting the invitation of President Patton of Princeton College and Professor Baldwin, the Association adjourned to meet at Princeton on Dec. 28th and 29th, 1894. J. McK. C.

MISCELLANEOUS.

The account of the Psychological Laboratory of Harvard University prepared by Professor MUNSTERBERG and issued by the University as part of its exhibit at the Chicago Exposition is an extremely useful pamphlet for those having charge of psychological laboratories. In addition to an account of the laboratory (with illustrations), a complete list of its apparatus, and the subjects of twenty-three researches in progress, it contains the names and addresses of seventy makers of, or dealers in, psychological apparatus, and an extended bibliography of the literature of experimental psychology.

In addition to the comprehensive treatise on Psychology by Prof. LADD, just published by Messrs. Charles Scribner's Sons, systematic works are announced by Mr. STOUT, St. John's College, Cambridge, Professor MÜLLER, Göttingen, and Professor EBBINGHAUS, Berlin.

Messrs. J. B. Lippincott & Co. have in press *System of Diseases of the Eye*, edited by Professor NORRIS and Dr. OLIVER of Philadelphia. The work is written by about sixty American and foreign authors, and includes the fullest treatment in English of the development, anatomy, and physiology of the eye and of the psychology of vision.

After Oct. 1894 the *Philosophische Monatshefte* is to be edited by Prof. BENNO ERDMANN of Halle and to be published in conjunction with the *Archiv für die Geschichte der Philosophie* by REIMER in Berlin. The two journals will be conducted on a common plan and will supplement each other, the former being devoted to systematic philosophy and the latter to history of philosophy.

Dr. L. E. Hill, Associate Professor of Physiology in University College, London, is offering during the Easter term of the current year a course of lectures on Physiological Psychology.

M. ALFRED FOUILLÉE, author of *Psychologie des idées-forces*, etc., has been elected a member of the French Academy of the Moral Sciences.

MSS. intended for publication in THE PSYCHOLOGICAL REVIEW during 1894 and books, etc., intended for review, should be sent to Prof. J. MCKEEN CATTELL, Garrison-on-Hudson, N.Y. From Oct. 1894 to Oct. 1895 they should be sent to Prof. J. MARK BALDWIN, Princeton, N. J.